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# J.T. SLOCOMB CO.

## CATALOG
## AND MEASURING BOOK

## № 16

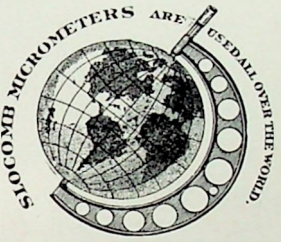
PROVIDENCE, RHODE ISLAND
-UNITED STATES OF AMERICA-

J. T. SLOCOMB

INVENTOR OF

"The longest lived micrometer that can be bought"

# MACHINISTS' MEASURING TOOLS

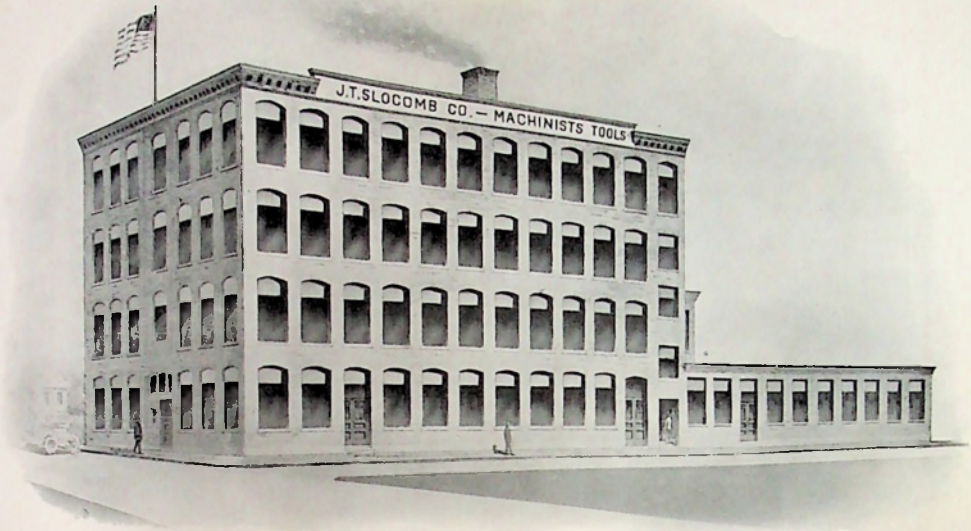



Reg. in U. S. Pat. Off.

CATALOG AND PRICE LIST
No. 16

W. U. T. CODE
CABLE ADDRESS MICROMETER, PROVIDENCE

MANUFACTURED BY
J. T. SLOCOMB COMPANY
PROVIDENCE, RHODE ISLAND
U. S. A.




Fireproof construction, well built and well lighted, affording the best facilities for the production of high grade tools

## Introductory

The business now conducted by J. T. Slocomb Company was established in 1891, for the manufacture of fine mechanics' tools, and has steadily grown since its establishment.

## New Tools

Since issuing our last catalog we have added several new tools, all of which are described and illustrated in this issue. As new tools may be added special circulars or inserts will be furnished.

## Our New Catalog

In this new catalog we endeavor to show our complete line of tools, together with a description, which we have tried to make cover points that are particularly of interest. Should more detailed description be required we shall be pleased to give it.

## Our Name

All our tools bear our name, and this name on a tool is our guarantee and your protection. Since the establishment of the business we have always endeavored to have every tool as nearly perfect as it is possible to make it. Our inspection is most rigid.

## Our Tools

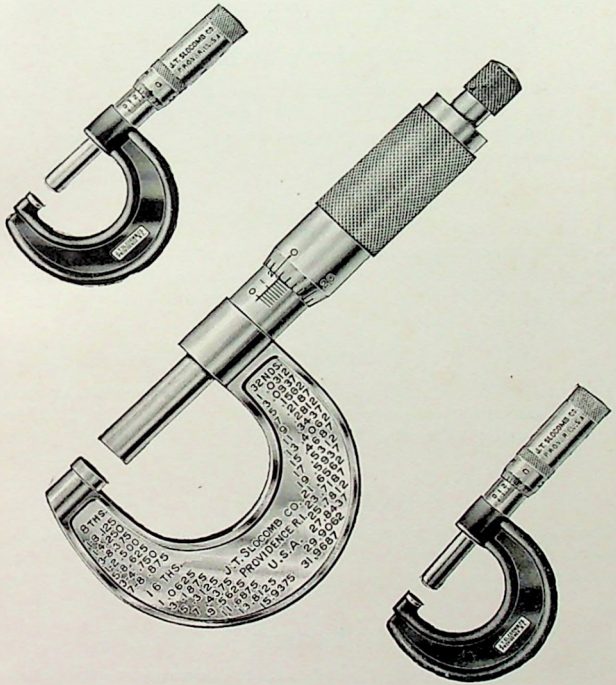
We *specialize* on *Micrometer Calipers* and *Combination Center Drills*, and as specialists on these tools, we are able to give quality and service.

# GUARANTEE

¶ We warrant every tool of our manufacture to be of the highest grade of material and workmanship and accurate in every particular. We also warrant them free from any imperfections of materials or defects in workmanship, and should any tool upon use prove defective we will replace it free of charge.

¶ We fully warrant them equal to any made.

¶ We cannot, however, assume the responsibility where original imperfection does not appear, nor can we replace tools which have been abused, or stamped with owner's name, changed, or otherwise experimented upon.




**Anybody can measure fairly accurate with a micrometer RAPID and ACCURATE work is attained only by practice**

# SUGGESTIONS FOR ORDERING

## Regular Goods

We recommend the use of tools regularly listed in our catalog rather than special ones. Regular tools are made in large quantities and carried in stock. Special tools must be made to order, taking a much longer time and costing much more.

## Language of Orders

In making up orders from this catalog, if you will be careful to use the names, numbers, and general language of the catalog, we shall be sure to understand, and thus errors in filling and delays will be avoided.

## Terms of Sale

To those satisfactorily rated in the mercantile reference books or those giving satisfactory references our terms are 30 days net. To all others the terms are cash with order.

## Guarantee

The guarantee on page 6 covers every tool bearing our name, and purchasers are fully protected from defective goods; no risk is taken in sending cash with order.

## To Dealers

We want to give every possible assistance to dealers who carry our tools in stock, and are ready to furnish cuts of our tools for use in advertisements of our customers, or in their catalog.

Catalogs and circulars of our tools will be furnished to dealers gratis at any time.

We want dealers to feel free to offer suggestions regarding our tools. Your ideas are always appreciated and will receive our careful consideration.

## To the Users of Our Tools

First we call your attention to the guarantee printed on page 6.

We are specialists in Micrometers and Center Drills, and endeavor in these lines to supply something better than it is possible to get elsewhere.

Any suggestions which you believe will help us to improve our line will be most welcome.

## Shipping Instructions

Show clearly on your order how we are to send goods, whether by mail, express, or freight. Goods sent by mail are at purchaser's risk. If definite instructions are not given we will use our own judgment.

## Mail Insurance

We have for some time, for the convenience of our customers, been insuring packages when sent by mail. The cost is small and, as it has evidently been so satisfactory, we shall continue it.

## Repairs

We endeavor to keep our repair charges as low as possible. All tools sent back for repairs should be plainly marked with name and address of sender on the outside of packages. A letter should in all cases be sent us giving full instructions for the repairs desired. Any tools returned for repairs should be returned with transportation charges fully prepaid.

## Special Tools

Special Tools always mean special work and special prices, so we recommend regular stock goods whenever possible. However, in case any special tools are ordered, care should be taken to give full description of what is wanted.

## Special Goods Not Returnable

We cannot take back goods made up on customers' orders according to special specifications. As such goods are made to meet the particular requirements of our customers they cannot be sold as regular goods to another.

## Missing Goods

Our goods are sold F. O. B. Providence, R. I., and we cannot be responsible for goods lost or damaged in transit.

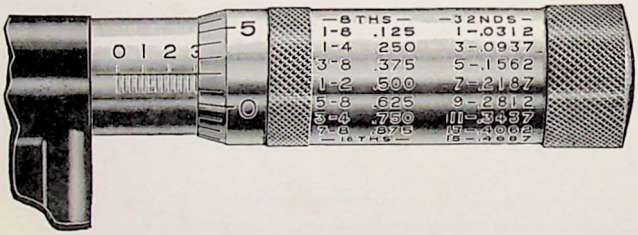
## Valuable and Exclusive Features of Slocomb Micrometers

The purpose of the Slocomb Micrometer is to meet the everyday requirements of machine shops with an instrument that is accurate, reliable, and durable to stand the every day usage of the shop.

One of the exclusive features of the Slocomb is its all tool steel screw. The screw is the heart of the micrometer and this hard tool steel screw, working in a nut that gives about four times the bearing surface of other micrometers, accounts for the extreme long life of the Slocomb.

The "I" section frame gives great rigidity with little weight, and while it may be of lesser importance on the 1 inch size, it grows rapidly in importance on the larger sizes.

The light weight contributes to the long life of the tool for the reason that it does not pound itself to pieces by handling.



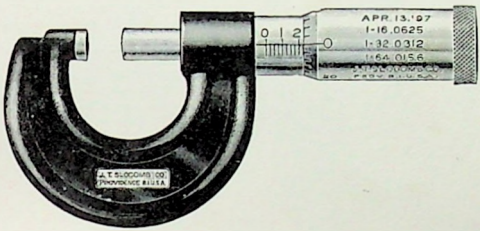

## Table of Decimal Equivalents on Thimble

A table of decimal equivalents consisting of 8ths, 16ths, and 32ds is stamped on thimbles of all our micrometers having the black enamel frame, as per above cut. This is on all sizes from the 1 inch to the 24 inch inclusive. The ribs on the edges of frame help to make a good finger hold, so that the instrument is held in a sensitive manner, contributing to accuracy in measuring.

Valuable features of the Slocomb are described to greater length on pages 83 to 86, Measuring Book, at back of this catalog.

THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT

## MICROMETER CALIPER




## No. 22—One Half Inch

This Caliper measures all sizes from 0 to ½ inch by thousandths of an inch. Where much measuring is done on lathe or grinder on sizes within the range of this caliper, it is preferred by many over the larger and heavier instruments. It weighs only 1¾ ounces and is readily carried in the vest pocket. This is the lightest micrometer made. The frame is drop forged from bar steel of an I section and is finished in black enamel. The general construction and adjustments are the same as in the larger instruments and this caliper is of the same high class.

### Metric Measure

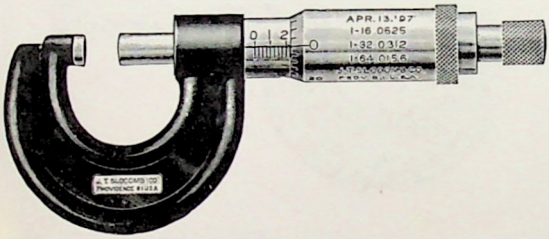
When instructed we can furnish at same price this micrometer for measuring 0 to 13 millimeters by hundredths of a millimeter.

No. 22. Without Friction Stop . . . . . **$3.50**

Cases for this micrometer are listed on pages 57 and 58.

THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT

## MICROMETER CALIPER




## No. 22—One Half Inch

**With Friction Stop**

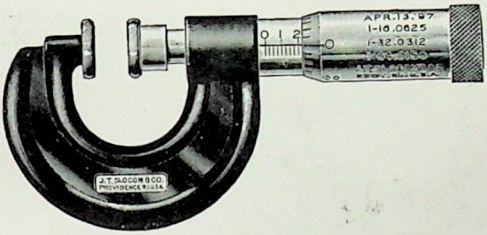
This Caliper is the same as the No. 22 illustrated on previous page except for the addition of the Friction Stop on end of thimble. This Friction Stop is a device that limits the amount of pressure that can be applied to the anvil or work and is intended to prevent mismeasurements through careless handling. This attachment can be applied to any Slocomb Micrometer. It is illustrated and described on page 100, Measuring Book, at the back of this catalog.

No. 22. With Friction Stop. . . . . **$4.00**

Cases for this micrometer are listed on pages 57 and 58.

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

## MICROMETER CALIPER




## No. 24—For Paper

This Caliper is intended for measuring paper or other soft material and has a large anvil and a wide cap on screw, so that when in use it has more bearing on the article being measured.

The frame is drop forged from bar steel and finished in black enamel.

It measures all sizes from 0 to .350 inch by thousandths of an inch.

A feature in this caliper is the removable cap on spindle. This cap is hardened steel and held in place by a small screw passing through, and is fitted somewhat loosely to spindle so it can conform to irregular surface of work.

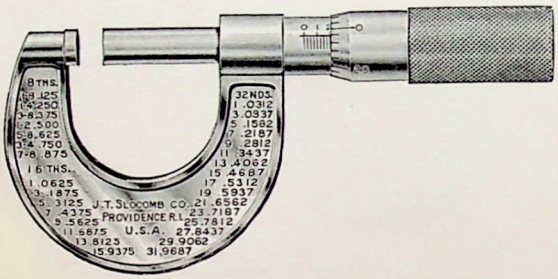
### Metric Measure

When instructed we can furnish at same price this micrometer graduated to read to hundredth millimeters, size 0 to 9 millimeters.

| | |
|---|---|
| No. 24. Without Friction Stop | $4.50 |
| No. 24. With Friction Stop | 5.00 |

Cases for this micrometer are listed on pages 57 and 58.

## MICROMETER CALIPER




## No. 26—One Inch

**All Metal Finish**

The frame of this Caliper like our others is drop forged from bar steel. It is then highly polished and next pressed in polished dies under a hydraulic pressure of 300 tons to the square inch, raising the figures showing decimal equivalents.

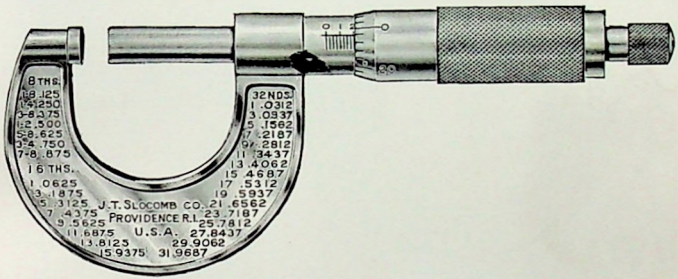
The raised edges and figures make a surface that is almost a knurl, and is a good finger hold. The figures are always bright, and show plainly. The pressing also stiffens the frame materially.

| | |
|---|---|
| No. 26. Without Friction Stop, as above | **$5.00** |
| No. 26. With Friction Stop | **5.50** |
| No. 26. With Friction Thimble | **6.00** |
| Graduated to read to .0001, extra | **1.00** |

Cases for this micrometer are listed on pages 57 and 58.

THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT

## MICROMETER CALIPER




## No. 26—One Inch

### With Friction Stop

This Caliper differs from the No. 26 in only one point, i. e., it has a Friction Stop.

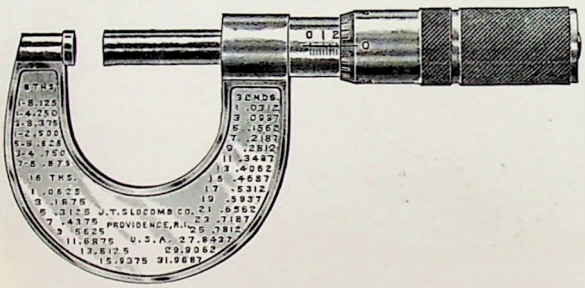
This attachment is fully described on page 100, Measuring Book. The objection to the click in the ratchet stop is overcome and its life is as long as the tool, as the spring does not require lubrication, and there is so much of the spring that it will not lose its tension.

No. 26. With Friction Stop, as above . . . . . **$5.50**
Graduated to read to .0001, extra . . . . . **1.00**

Cases for this micrometer are listed on pages 57 and 58.

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

## MICROMETER CALIPER




## No. 26—One Inch

### With Friction Thimble

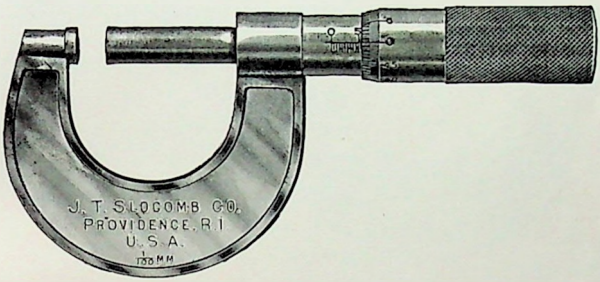
There is some disadvantage in a friction stop applied to the end of thimble of a 1 inch micrometer in the usual way. When holding the micrometer and trying to operate the stop by fingers of the same hand, its reach is often too great. By putting the stop further down on the thimble, it fits the hand better. It is right under your thumb. Construction of these stops is explained on page 100, Measuring Book, at the back of this catalog.

No. 26. With Friction Thimble, as above . . . . . **$6.00**
Graduated to read to .0001, extra . . . . . **1.00**

Cases for this micrometer are listed on pages 57 and 58.

THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT

## MICROMETER CALIPER




### No. 26M Metric 0 to 25 m/m

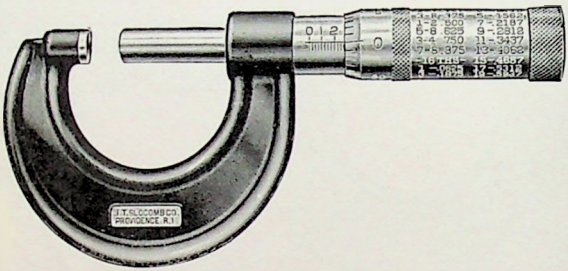
This Caliper corresponds to our No. 26 English and is furnished like that one with either the friction stop or friction thimble. It is graduated to read in hundredths of a millimeter 0 to 25 millimeters. The frame is finished like the No. 26 except of course it does not have the table of decimal equivalents of the inch.

| | |
|---|---|
| No. 26M. Without Friction Stop . . . . . | $5.00 |
| No. 26M. With Friction Stop. . . . . | 5.50 |
| No. 26M. With Friction Thimble . . . . . | 6.00 |

Cases for this micrometer are listed on pages 57 and 58.
For large sizes of metric micrometers, see pages 20, 21, 22, 23 and 24.

THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT

## MICROMETER CALIPER




## No. 25—One Inch

This Caliper measures all sizes from 0 to 1 inch by thousandths of an inch.

Finished in black enamel. Has drop-forged frame of I section style giving great strength and rigidity with little weight. Decimal equivalents stamped on thimble.

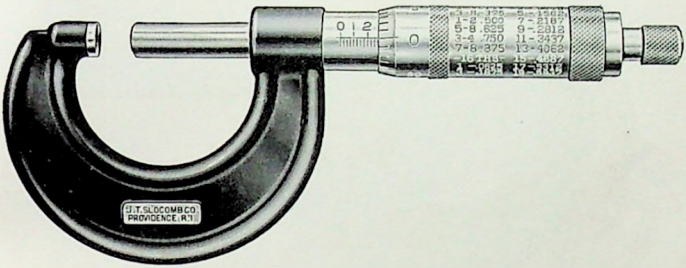
### Metric Measure

When instructed we can furnish at same price this micrometer for measuring 0 to 25 millimeters by hundredths of a millimeter.

| | |
|---|---|
| No. 25. Without Friction Stop (as above) | **$4.00** |
| No. 25. With Friction Stop | **4.50** |
| Graduated to read to .0001, extra | **1.00** |

Cases for this micrometer are listed on pages 57 and 58.
For larger sizes, see pages 22 and 23.

## MICROMETER CALIPER




## No. 25—One Inch

### With Friction Stop

This Micrometer is like the No. 25 except the addition of the Friction Stop.

This illustration is given to show the appearance of the micrometer with this attachment and it will serve to show what this attachment will add to any of the outside micrometers listed on the following pages.

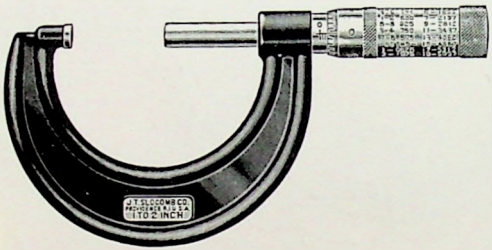
### Metric Measure

When instructed, we can furnish at same price this micrometer for measuring 0 to 25 millimeters by hundredths of a millimeter.

| | |
|---|---|
| No. 25. With Friction Stop, as above | $4.50 |
| Graduated to read to .0001, extra | 1.00 |
| Friction Stop on any outside micrometer, extra | .50 |

Cases for this micrometer are listed on pages 57 and 58.
For larger sizes, see pages 22 and 23.

## MICROMETER CALIPER




### No. 27—Two Inch

This Caliper measures all sizes from 1 to 2 inches inclusive. The frame is drop forged from bar steel and finished in black enamel. Decimal equivalents are stamped on thimble, I section frame, etc.

**Metric Measure**

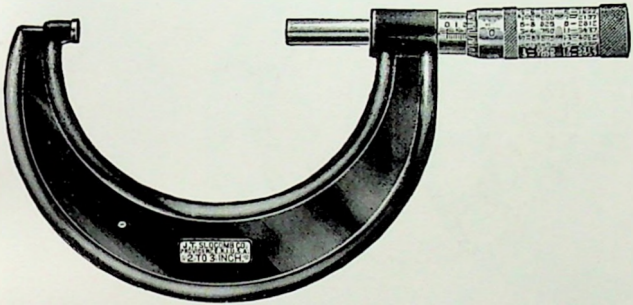
When instructed we can furnish this micrometer for measuring in hundredths of a millimeter, size from 25 mm. to 50 mm., at same price.

| | |
|---|---|
| No. 27. Without Friction Stop | **$4.50** |
| No. 27. With Friction Stop | **5.00** |
| Graduated to read to .0001, extra | **1.00** |

Cases for this micrometer are listed on pages 57 and 58.
For larger sizes, see pages 22 and 23.

THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT

## MICROMETER CALIPER



## No. 28—Three Inch

This Caliper measures all sizes from 2 to 3 inches by thousandths of an inch. Frame is forged from bar steel and finished in black enamel. Decimal equivalents are stamped on thimble, I section frame, etc.

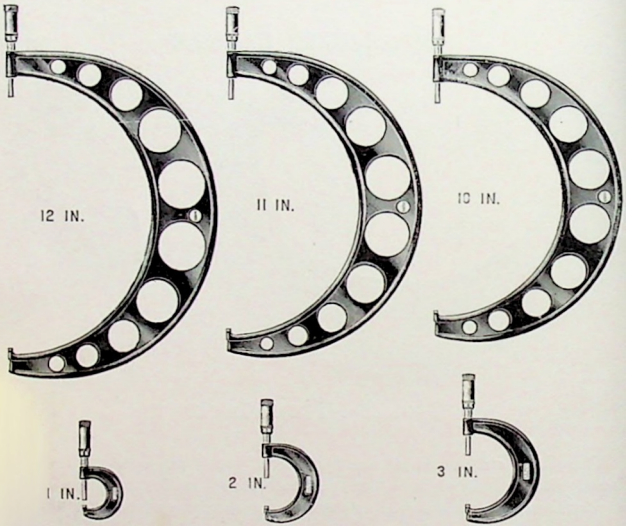
### Metric Measure

When instructed we can furnish at same price this micrometer for measuring in hundredths of a millimeter from 50 to 75 millimeters.

| | |
|---|---|
| No. 28. Without Friction Stop | $5.00 |
| No. 28. With Friction Stop | 5.50 |
| Graduated to read to .0001, extra | 1.00 |

Cases for this micrometer are listed on pages 57 and 58.
For larger sizes, see pages 22 and 23.

THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT




We list here micrometers having a range of one inch or 25 millimeters for each size, covering all sizes to 24 inches inclusive and from 0 to 600 millimeters Metric Measure.

The frames on sizes 1 to 9 inches inclusive are drop forged from bar steel, and sizes 10 inches and larger are of high grade steel castings with holes through them for lightness.

The heads and measuring screws on all are the same. Each has a range of screw of one inch or 25 millimeters.

The size given on the cut shows the maximum, the minimum being one inch or 25 millimeters less in each case.

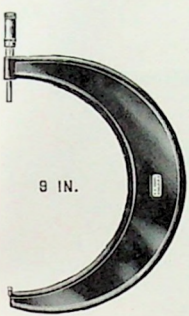
Frames are finished in black enamel. Micrometers for English measurement sent unless otherwise instructed.

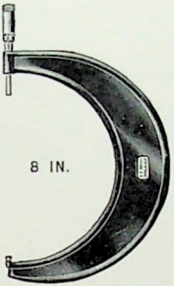
For detailed description of these micrometers see pages 83 to 85, Measuring Book.

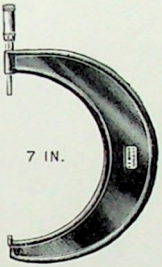
These micrometers are put up in sets containing different sizes; see pages 36 to 43.

THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT

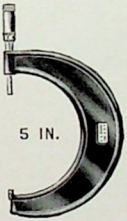
# Micrometer Calipers from 1 to 24 Inches

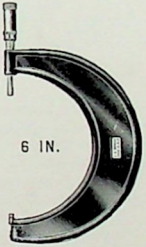







## Price List

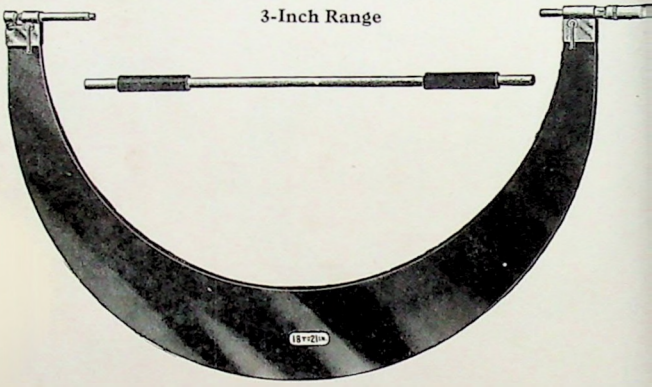
| Inches | Metric | Without Friction Stop | With Friction Stop | Inches | Metric | Without Friction Stop |
|---|---|---|---|---|---|---|
| 0 to 1 in. | 0 to 25 mm. | $4.00 | $4.50 | 12 to 13 in. | 300 to 325 mm. | $12.50 |
| 1 to 2 in. | 25 to 50 mm. | 4.50 | 5.00 | 13 to 14 in. | 325 to 350 mm. | 13.50 |
| 2 to 3 in. | 50 to 75 mm. | 5.00 | 5.50 | 14 to 15 in. | 350 to 375 mm. | 14.50 |
| 3 to 4 in. | 75 to 100 mm. | 5.50 | 6.00 | 15 to 16 in. | 375 to 400 mm. | 15.50 |
| 4 to 5 in. | 100 to 125 mm. | 6.00 | 6.50 | 16 to 17 in. | 400 to 425 mm. | 17.00 |
| 5 to 6 in. | 125 to 150 mm. | 7.00 | 7.50 | 17 to 18 in. | 425 to 450 mm. | 18.00 |
| 6 to 7 in. | 150 to 175 mm. | 8.00 | 8.50 | 18 to 19 in. | 450 to 475 mm. | 19.00 |
| 7 to 8 in. | 175 to 200 mm. | 8.50 | 9.00 | 19 to 20 in. | 475 to 500 mm. | 20.00 |
| 8 to 9 in. | 200 to 225 mm. | 9.00 | 9.50 | 20 to 21 in. | 500 to 525 mm. | 21.00 |
| 9 to 10 in. | 225 to 250 mm. | 9.50 | 10.00 | 21 to 22 in. | 525 to 550 mm. | 22.00 |
| 10 to 11 in. | 250 to 275 mm. | 10.00 | 10.50 | 22 to 23 in. | 550 to 575 mm. | 23.00 |
| 11 to 12 in. | 275 to 300 mm. | 11.50 | 12.00 | 23 to 24 in. | 575 to 600 mm. | 24.00 |

Any of above micrometers to 6 inches inclusive graduated to read to .0001", extra, **$1.00.**

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

## LARGE MICROMETER

3-Inch Range



The above cut shows a Caliper we make in sizes above 18 inches English and 450 millimeters Metric. The frame is a steel forging. Each tool is provided with three End Measure Anvils, a 1-inch, 2-inch and 3-inch (or 25, 50 and 75 mm. in case of metric), which are held by split clamp and rest against adjusting screw. Also one Standard End Measure as shown in cut for adjusting to smallest size. A feature of this tool is in the gap at anvil end, allowing face of End Measure and adjusting screw to be wiped clean before contact is made, and then allowing for inspection by sighting through at any time. This tool is also provided with clamp for locking spindle in any desired position. The frame is finished in black enamel.

We list and carry in stock the four sizes given below, each having a range of three inches English or 75 millimeters Metric, but call attention that we can furnish on special orders this style of micrometer in larger sizes. Prices on application.

The first two sizes given duplicate single micrometers of inch range listed on pages 22 and 23, but while we recommend the inch range tools where there is any considerable use we are prepared to furnish either.

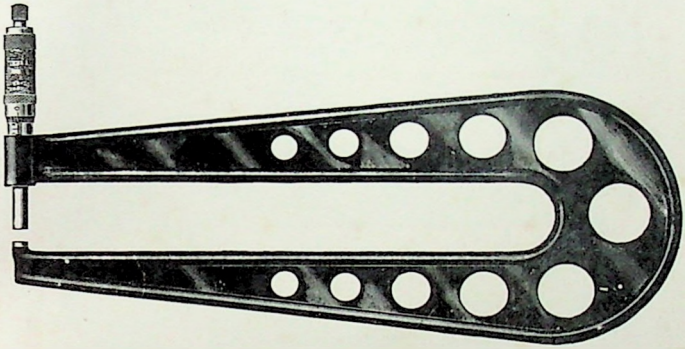
### Metric Measure

Micrometers of this style for measuring in hundredths of a millimeter can be furnished at same prices.

| | English | Metric | |
|---|---|---|---|
| No. 51. | 18 to 21 inches; | 450 to 525 mm. . . . . | **$36.00** |
| No. 52. | 21 to 24 inches; | 525 to 600 mm. . . . . | **40.00** |
| No. 53. | 24 to 27 inches; | 600 to 675 mm. . . . . | **45.00** |
| No. 54. | 27 to 30 inches; | 675 to 750 mm. . . . . | **50.00** |

For sizes 24 inches and less with inch range, see pages 22 and 23.

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**



## One Inch Rolling Mill or Stereotyper's Micrometer Caliper

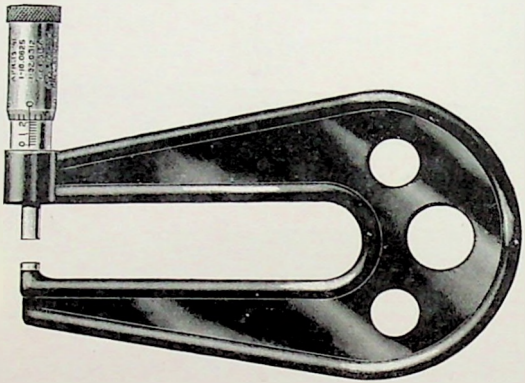
This Caliper measures from 0 to 1 inch or from 0 to 25 millimeters and will measure on a sheet 9 inches or to the center of an 18-inch sheet.

They are all provided with our improved friction stop which serves the purpose of a speeder for the screw as well as guarding against springing the frame by applying too much pressure to the thimble.

The anvil is made flat for measuring plates or rounded for use in measuring the curved stereotype plates. The micrometer head with its adjustments is the same as used in all Slocomb Micrometers.

Price with friction stop and with either flat or rounded anvil . . . . . **$9.50**

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**



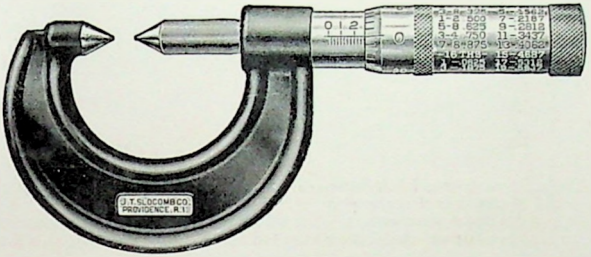
## Half Inch Rolling Mill Micrometer Caliper

This Caliper measures from 0 to ½ inch or from 0 to 13 millimeters and will measure on a sheet 3 inches or to the center of a 6-inch sheet.

| | |
|---|---|
| Price either English or Metric Measure | **$5.00** |
| With Friction Stop | **5.50** |

THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT

## SCREW THREAD MICROMETER CALIPER




### No. 29

This Caliper will not measure the actual diameter of a V thread screw, but for purposes of comparison it has a wide range of uses.

It is valuable for making a tap same diameter as some other tap or screw, or a few thousandths larger or smaller.

For cutting screw threads in the lathe to fit nuts the tap may be measured and then the threads readily cut to same size and to fit nuts, without the common cut-and-try method and its consequent loss of time.

The terminals are not made to a sharp point, but instead are flatted to about $\frac{1}{64}$ inch diameter, and the tool is adjusted to 0 when these flat points are in contact, so it may be used same as any other micrometer, when it is desired to measure at the bottom of a groove or a small recess, the thickness in the center of twist drills, or similar work.

Frame finished in black enamel.

#### Metric Measure

When instructed we can furnish at same prices this style micrometer for measuring in hundredths of a millimeter.

| | English | Metric | |
|---|---|---|---|
| No. 29A. | 0 to 1 inch, | 0 to 25 mm. . . . . | $4.50 |
| No. 29C. | 1 to 2 inch, | 25 to 50 mm. . . . . | 5.00 |
| No. 29E. | 2 to 3 inch, | 50 to 75 mm. . . . . | 6.50 |

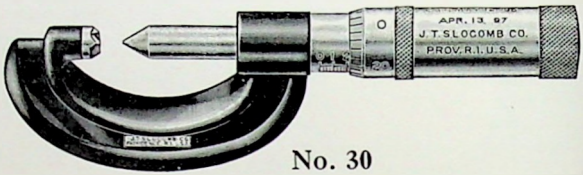
For larger sizes, add $1.50 to regular list as given on page 23.

Micrometers for English measurement sent unless otherwise ordered.

Cases for these micrometers are listed on pages 57 and 58.

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

# STANDARD SCREW THREAD MICROMETER

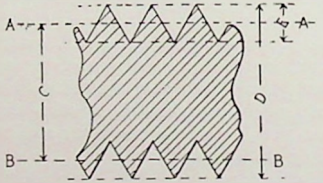



## No. 30

These Screw Thread Micrometers provide the best means known for the accurate measuring of screw threads.

Our micrometer is especially adapted on account of all the adjustments being made inside the thimble and we are able to use a solid anvil, which is much more reliable than when this piece is fitted loose.

The anvil is V shaped, and the end of the screw pointed. The V in the anvil is sharp enough and the pointed end of the screw flatted enough so that they will not rest on the top or bottom of the thread being measured, but instead will rest only on the angle or cut surface of the thread. It is a well-known fact that the outside diameter has little to do with the actual size of a screw, and this micrometer provides a way of making the actual measurement on the angle.




Referring to the small sectional cut: *A-B* are the pitch lines of the thread and *C* is the measurement which is shown by these micrometers. This is the outside diameter, less one-half the double depth of thread or one depth of thread less than the outside diameter.

This depth may be found as follows:

| | |
|---|---|
| Depth of V threads | = .866 ÷ number of threads to 1 inch. |
| Depth of U. S. S. threads | = .6495÷ number of threads to 1 inch. |
| Depth of Whitworth threads | = .640 ÷ number of threads to 1 inch. |
| Depth of A. S. M. E. threads | = .6495÷ number of threads to 1 inch. |
| Depth of British Asso. threads | = .60 ÷ number of threads to 1 inch. |
| Depth of Metric threads | = .6495÷ Pitch. |

For further matter and tables, see pages 80 to 82, Measuring Book, at the back of this catalog.

Cases for these micrometers are listed on pages 57 and 58.

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

For U. S. S. Whitworth and International threads, the point of the spindle has to be flatted. This makes the range of caliper somewhat more limited than for V threads. The fixed anvil is limited in its capacity for if made large enough to measure a 10 pitch, it would be too wide at the top to measure a 20 pitch. The anvil, therefore, largely governs the range of the micrometer. It will be seen that a micrometer with small anvil will measure large sizes, but in practice the small anvil does not cover enough of a coarse thread, is hard to handle and it is found better to use a number of different size anvils, the exact number required is a matter largely of opinion, but for stock sizes we list the following:

No. 30 C. 1 inch capacity 0 to 1 inch, range 8 to 13 pitch, V or U. S. S. . . . . **$6.50**

No. 30 E. 1 inch capacity 0 to 1 inch, range 14 to 20 pitch, V or U. S. S. . . . . **6.50**

No. 30 G. 1 inch capacity 0 to 1 inch, range 22 to 30 pitch . . . . . **6.50**

No. 30 J. 1 inch capacity 0 to 1 inch, range 32 to 40 pitch, V threads only. . . . . **6.50**

No. 30 L. 2 inch capacity 1 to 2 inch, range 4½ to 7 pitch, V or U. S. S. . . . . **7.50**

No. 30 M. 2 inch capacity 1 to 2 inch, range 8 to 13 pitch, V or U. S. S. . . . . **7.50**

No. 30 P. 3 inch capacity 2 to 3 inch, range 6 to 10 pitch, V or U. S. S . . . . . **8.00**

For large sizes add $3.00 to list on regular micrometers. See page 23.

Range and form of thread is marked on the thimble.

Micrometers for other forms of threads and other pitches as well as for metric threads made to order, prices quoted on application.

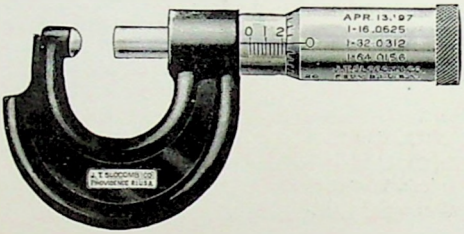
For table of constants for threads, see page 82, Measuring Book, at end of this catalog.

Cases for these micrometers are listed on pages 57 and 58.

In ordering special thread micrometers, be sure to give form of thread, range of thread required and range of diameters.

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

## TUBE MICROMETER




### No. 33

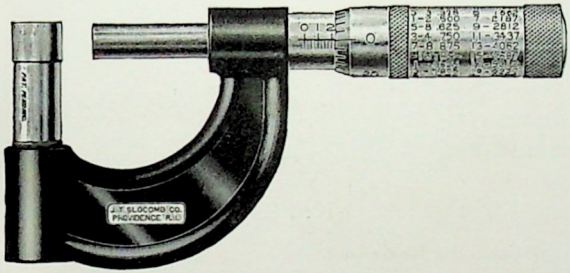
This Caliper, like the No. 31, is intended to measure the walls of tubes, etc. The anvil will enter a hole 3/8 inch in diameter to a depth of 3/8 inch. The measuring screw has a range of 1/2 inch or 13 millimeters, Metric Measure.

| | |
|---|---|
| Price, without Friction Stop | **$3.50** |
| Price, with Friction Stop | **4.00** |

Cases for these micrometers listed on pages 57 and 58.

THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT

## TUBE MICROMETER




## No. 31

This Caliper is intended to measure the walls of tubes, the distance of a hole from the edge of a piece and other similar work. The anvil will enter a hole 3/8 inch diameter to a depth of 3/4 inch. The measuring screw has a range of one inch. These calipers can be furnished to special order with anvil to enter holes as small as 2/10 inch.

### Metric Measure

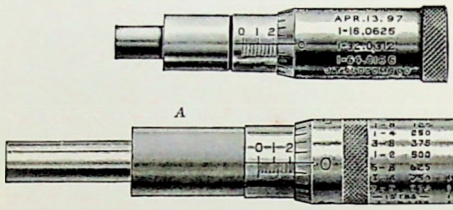
When instructed we can furnish at same prices these micrometers for measuring in hundredths of a millimeter.

| | | English | Metric | |
|---|---|---|---|---|
| No. 31. | Without Friction Stop, | 0 to 1 inch, | 0 to 25 mm. . . . | **$5.00** |
| No. 31. | With Friction Stop, | 0 to 1 inch, | 0 to 25 mm. . . . | **5.50** |

Micrometers for English measurement sent unless otherwise ordered.

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

## MICROMETER HEAD




## No. 32

These Micrometer Heads are useful for purposes of fine adjustments in tools or machines. They are intended to be fastened by sweating in with soft solder or split clamp. We carry in stock heads as shown in the illustrations.

The diameter *A* on the ½ inch head is ⅜ inch and the length is 15/32 inch. The diameter *A* on the 1 inch head is 7/16 inch and the length is ¾ inch.

As the adjusting screw in our micrometer, for wear on end of screw and anvil, is inside the thimble, our micrometer heads are complete with adjustments, making them especially suited for such a purpose.

These heads have a range of ½ inch and 1 inch and are regularly graduated to read to thousandths of an inch, but, when desired, the 1 inch head can be furnished graduated to read to ten thousandths of an inch.

Either head can be furnished with friction stop.

### Metric Measure

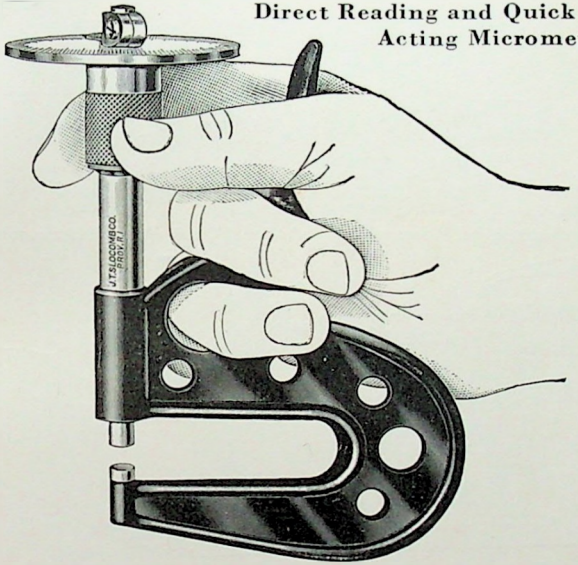
When desired we can furnish at same prices these micrometer heads graduated to read in hundredths of a millimeter. They have a range in metric sizes of 13 and 25 millimeters respectively.

| | English | Metric | |
|---|---|---|---|
| No. 32 A. Without Friction Stop, | 0 to ½ inch, | 0 to 13 mm. . . | **$2.50** |
| No. 32 B. With Friction Stop, | 0 to ½ inch, | 0 to 13 mm. . . | **3.00** |
| No. 32 C. Without Friction Stop, | 0 to 1 inch, | 0 to 25 mm. . . | **3.00** |
| No. 32 D. With Friction Stop, | 0 to 1 inch, | 0 to 25 mm. . . | **3.50** |

Micrometer Heads for English measurements sent unless otherwise ordered.

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

## Direct Reading and Quick Acting Micrometer



This Caliper has a multiple pitch screw giving a lead of ¼ inch, the complete range of caliper, so one revolution of screw only is used, allowing the graduations to be in one circle on dial. The caliper is held and operated as shown entirely by one hand, leaving the other to handle the work being measured. It measures on a sheet 2⅜ inches or to the center of a 4¾ inch sheet. The dial revolves but the pointer and spindle do not.

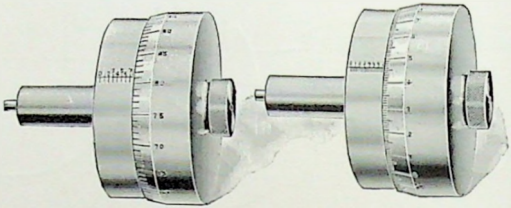
The caliper shown in illustration has friction thimble so that different people always get the same measurement. This feature is principally valuable when measuring on soft material.

This caliper is essentially a manufacturing instrument for work that has to be measured rapidly and where highly skilled operators are not employed.

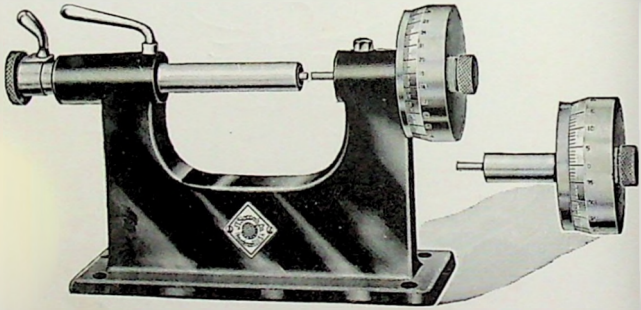
Made with large measuring terminals it is successfully used in rubber mills for measuring sheet rubber, for accurately measuring the thickness of card clothing, for measuring cloth, paper and with small terminals as a sheet metal gauge. We can furnish this caliper to order with a lighter frame measuring on a sheet one inch only.

Price, without Friction Thimble reading to .001 inch **$15.00**
Price, fitted with Measuring Terminals ¾ inch diameter for measuring soft material. . . . . **18.00**
Made to order for special purposes.

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**



Interchangeable Measuring Heads for 6-Inch Bench Micrometer



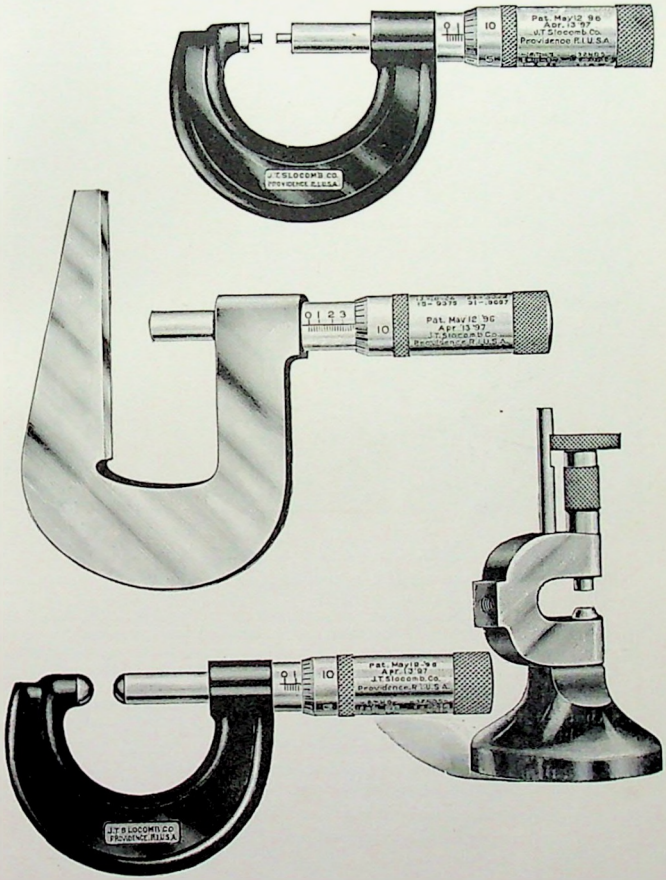
## New Six-Inch Bench Micrometer

This Micrometer has a range from 0 to 6 inches and is provided with two interchangeable measuring heads. One of these is graduated to read in ten thousandths of an inch direct off the thimble, has a very accurate screw and is suitable for making gauges, or in any work where extra fine measurements are required. The other head has a 10 pitch screw, is graduated to measure in thousandths of an inch, and is intended for work where rapid measuring is required to a degree of accuracy of one-quarter of a thousandth.

The thimbles are made of aluminum 4 inches in diameter, making the graduations coarse. The quick acting head is direct reading. The first figure is taken from the sleeve and the rest from thimble. Lines and figures are large so readings can be made two or three feet away. The anvil has two adjustments, first sliding through split clamp in frame, and second by fine screw adjustment through center. For further description see pages 91 and 92, Measuring Book.

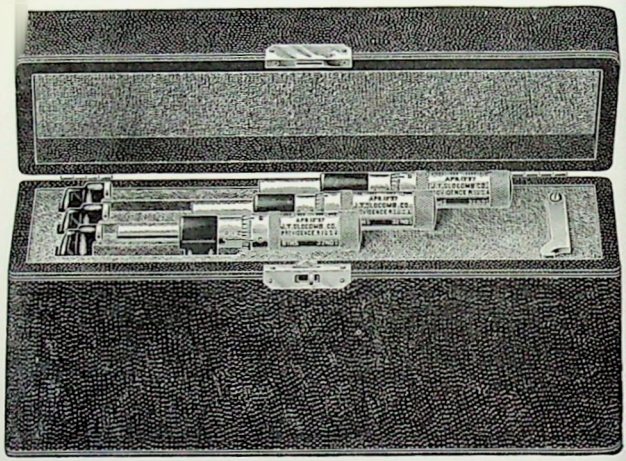
| | |
|---|---|
| Price, as shown with two heads | $125.00 |
| Price, as shown with one head | 100.00 |
| Price of heads alone, each | 40.00 |
| Price of set of end measures 1 to 6 inches inclusive (extra) | 7.75 |

THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT




A few of the Micrometers we have made to special order.

## MICROMETER SET



## No. 18—0 to 3 Inches

The micrometers are all of our regular style, as shown singly on pages 18, 20 and 21 of this catalog.

Each micrometer is graduated to read to thousandths of an inch, although they can, when so ordered, be graduated to read to ten thousandths of an inch, at an extra list of $1.00 for each micrometer, or $3.00 extra per set.

Furnished in a handsome, substantial case, covered with Morocco leather and velvet lined. Dimensions, 8¾x3x4½ inches.

These are regularly sent without friction stops unless otherwise ordered.

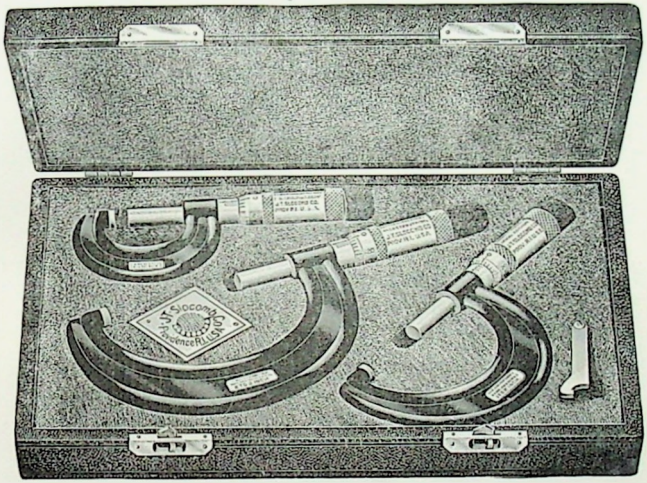
### Metric Measure

This set is also furnished with micrometers measuring 0 to 75 millimeters by hundredths of a millimeter, at same prices.

| | |
|---|---|
| Price complete, without Friction Stops . . . . . | **$14.30** |
| Price complete, with Friction Stops. . . . . | **15.80** |
| Price, Case only . . . . . | **1.25** |

THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT

## MICROMETER SET



## No. 21—0 to 3 Inches

The cut given gives a very good idea of this set of three micrometers with a range from 0 to 3 inches. All the micrometers are of our regular style, as listed singly on other pages.

Each micrometer is graduated to read to thousandths of an inch, although they can be furnished, when desired, graduated to read to ten thousandths of an inch, at an extra list of $1.00 for each micrometer, or $3.00 extra per set.

The micrometers lie flat in a handsome velvet-lined, Morocco-covered case. Dimensions, 9½x6¾x1½ inches.

These are furnished, unless otherwise ordered, without friction stops.

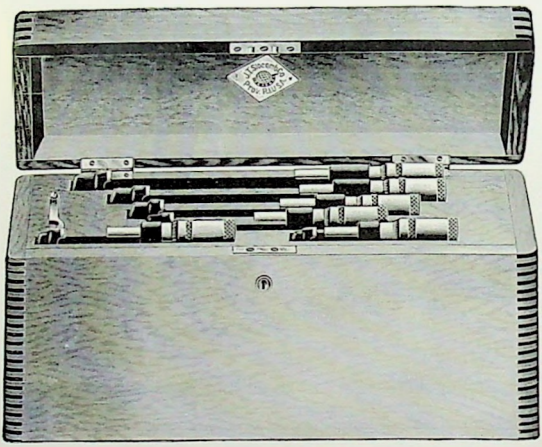
### Metric Measure

This set is also furnished with micrometers measuring 0 to 75 millimeters by hundredths of a millimeter, at same prices.

| | |
|---|---|
| Price complete, without Friction Stops | **$14.30** |
| Price complete, with Friction Stops | **15.80** |
| Price, Case only | **1.25** |

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

## MICROMETER SET



## No. 19—0 to 6 Inches

This set consists of one each of our regular micrometers, as listed singly on pages 22 and 23, 1, 2, 3, 4, 5, and 6 inches, and makes an excellent set for inspection or general shop use.

Each micrometer is graduated to read by thousandths of an inch, although they can be furnished, when so desired, graduated to read to ten thousandths of an inch, at an extra list of $1.00 for each micrometer, or $6.00 extra per set.

The micrometers are set with the frame down in the case, all being on an even plane at the top of the case. The case itself is of quartered oak, beautifully finished, and has lock and key. Dimensions, 14¼x5¼x7 inches.

The micrometers are furnished, unless otherwise ordered, without friction stop.

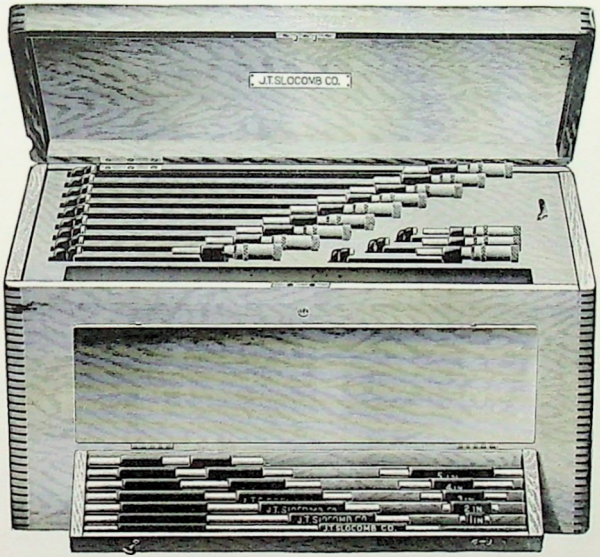
**Metric Measure**

This set is also furnished with micrometers measuring 0 to 150 millimeters by hundredths of a millimeter, at same prices.

| | |
|---|---|
| Price complete, without Friction Stops | **$36.00** |
| Price complete, with Friction Stops | **39.00** |
| Price, Case only | **5.00** |

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

## MICROMETER SET




### No. 22—0 to 12 Inches

This set consists of 12 micrometers 1 inch to 12 inches, each with a range of one inch, as listed on page 23, 12 Standard End Measure Rods by one inch steps from 1 inch to 12 inches inclusive and a substantial and beautifully finished quartered oak case to contain them.

Each micrometer is graduated to read in thousandths of an inch. The end measure rods are contained in a separate oak case as shown at the front in the illustration. This small case fits in the large slot in the front of the main case. The dimensions of the main case are 20½x13¼x11 inches. Case is provided with good lock and closes tight, keeping the set of instruments from the dust and dirt. Unless otherwise ordered, micrometers are furnished without friction stops.

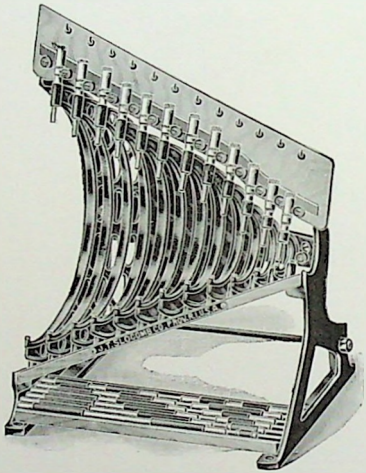
**Metric Measure**

This set is also furnished with micrometers measuring 0 to 300 millimeters by hundredths of a millimeter, at same prices.

| | |
|---|---|
| Price complete, without Friction Stops | $115.40 |
| Price complete, with Friction Stops | 121.40 |
| Price, Case only | 10.00 |

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

## MICROMETER SET



### No. 20—0 to 12 Inches

This set consists of twelve micrometers, one each 1 inch to 12 inches, giving a range from 0 to 12 inches inclusive, as listed singly on page 23, and is a very serviceable set for tool room or general shop use.

Each micrometer is graduated to read in thousandths of an inch.

The rack is made with cast iron ends, black enameled finish with oak slats. The partitions are rubber buttons which keep the tools separated, and yet are not injurious to them. Hooks are provided above each tool for workman's check.

The lower oak slat is grooved, and contains set of 12 end measures from 1 to 12 inches inclusive. The rack is 21½ inches high with a base dimension of 15¾x13 inches. Your tool room is not complete without this set.

Micrometers are furnished, unless otherwise ordered, without friction stop.

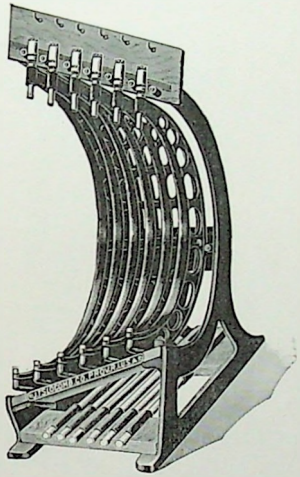
**Metric Measure**

This set is also furnished with micrometers measuring 0 to 300 millimeters by hundredths of a millimeter, at same prices.

| | |
|---|---|
| Price complete, without Friction Stops | **$111.90** |
| Price complete, with Friction Stops | **117.90** |
| Price, Rack only | **5.00** |

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

## MICROMETER SET



## No. 24—12 to 18 Inches

This set consists of six micrometers and six end measures, measuring from 12 to 18 inches inclusive.

Each micrometer is graduated to read in thousandths of an inch.

The rack is made with black enameled cast iron sides with oak slats and rubber button partitions. Hook above each tool for workman's check.

End measures are kept on lower slat, which is grooved for the purpose.

The rack is 27½ inches high, and has base dimensions of 19½x9½ inches.

Micrometers are furnished without friction stops, unless otherwise ordered. This set starts at 12 inches where the No. 20 set ends.

### Metric Measure

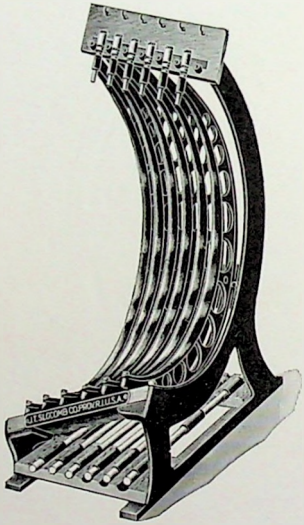
This set is also furnished when so desired with micrometers measuring 300 to 450 millimeters by hundredths of a millimeter, at same prices.

Price complete, without Friction Stops. . . . . $120.50

Price, Rack only . . . . . 6.75

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

## MICROMETER SET



### No. 26—18 to 24 Inches

This set consists of six micrometers and six end measures measuring from 18 to 24 inches inclusive.

Each micrometer is graduated to read in thousandths of an inch.

The rack is made with black enameled cast iron sides with oak slats and rubber partitions. Hook above each tool for workman's check.

End measures are kept on lower slat, which is grooved for this purpose.

The rack is 33½ inches high and has base dimensions of 11½x26 inches.

Micrometers are furnished without friction stops unless otherwise ordered. This set starts at 18 inches where the No. 24 set ends.

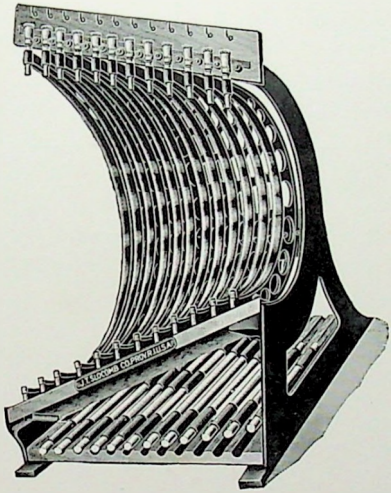
**Metric Measure**

This set is also furnished when so desired with micrometers measuring 450 to 600 millimeters by hundredths of a millimeter, at same prices.

Price complete, without Friction Stops . . . . . **$174.00**
Price, Rack only. . . . . **8.75**

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

## MICROMETER SET



## No. 28—12 to 24 Inches

This set consists of twelve micrometers and twelve end measures from 12 to 24 inches inclusive, all furnished in one rack. This set in connection with Set No. 20 listed on page 40 gives a range 0 to 24 inches.

Each micrometer is graduated to read in thousandths of an inch.

The rack is made with black enameled cast iron sides with oak slats and rubber partitions. Hook above each tool for workman's check.

End measures are kept on lower slat, which is grooved for the purpose.

This rack is 33½ inches high and has base dimensions of 17½x26 inches.

Micrometers are furnished without friction stops unless otherwise ordered. This set starts at 12 inches where the No. 20 set ends.

### Metric Measure

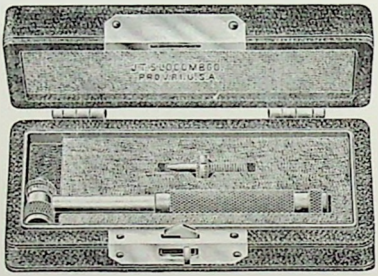
This set is also furnished when so desired with micrometers measuring 300 to 600 millimeters by hundredths of a millimeter, at same prices.

Price complete, without Friction Stops . . . . . **$288.50**

Price, Rack only. . . . . **10.00**

**THE LONGEST LIVED MICROMETER THAT CAN BE BOUGHT**

# INSIDE MICROMETER CALIPER



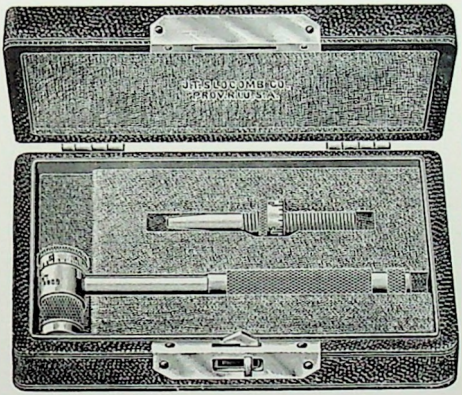
Set No. 101

This Caliper is intended to measure inside diameters from ½ inch to 1 inch by thousandths of an inch. It is provided with two interchangeable screws. With the shorter one in place the instrument measures from ½ inch to ¾ inch and from ¾ to 1 inch with the longer screw. This caliper is provided with a handle so that measurements can be taken throughout a bore. This is the smallest inside micrometer made by anyone as far as we know. For further description see pages 95 and 96, Measuring Book.

With genuine Morocco leather, velvet lined case. . . **$5.00**

Furnished also in Metric measure at same price.

## INSIDE MICROMETER CALIPER



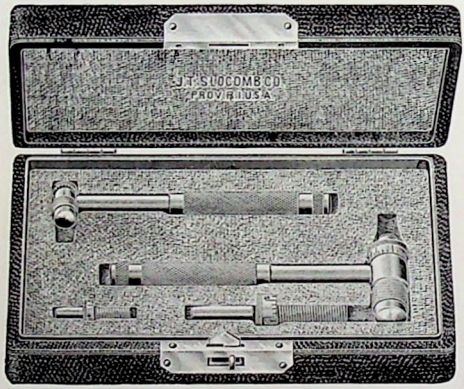

**Set No. 102**

This Caliper is intended to measure inside diameters from 1 inch to 2 inches by thousandths of an inch. It is constructed the same as the No. 101 but is a larger instrument with two interchangeable screws, one measuring from 1 inch to 1½ inches and the other from 1½ inches to 2 inches. This caliper is provided with a handle so that measurements can be taken throughout the entire length of a bore.

With genuine Morocco leather, velvet lined case. . . **$5.00**

Furnished also in Metric measure at same price.

## INSIDE MICROMETER CALIPER SET



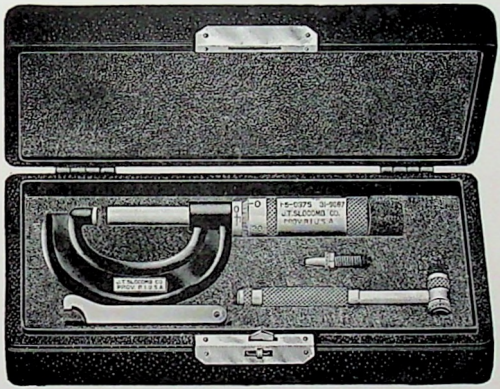

**Set No. 103**

This Inside Micrometer set measures all inside diameters from ⅜ inch to 2 inches by thousandths of an inch. This set comprises the No. 101 set and the No. 102 set in one case.

With genuine Morocco leather, velvet lined case, complete . . . . . **$10.00**

Furnished also in Metric measure at same price.

## INSIDE MICROMETER CALIPER SET

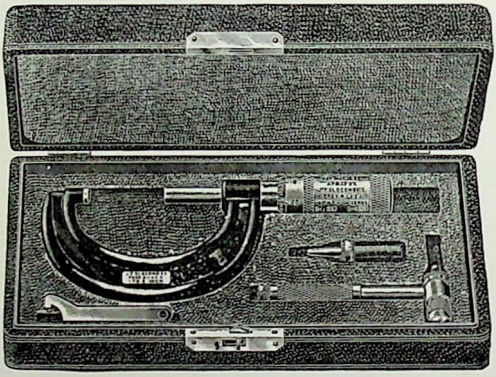


**Set No. 104**

This Micrometer set consists of the No. 101 inside micrometer, measuring from ½ inch to 1 inch, together with a No. 25 1 inch outside micrometer.

With genuine Morocco leather, velvet lined case, complete . . . . . **$9.00**

## MICROMETER CALIPER SET

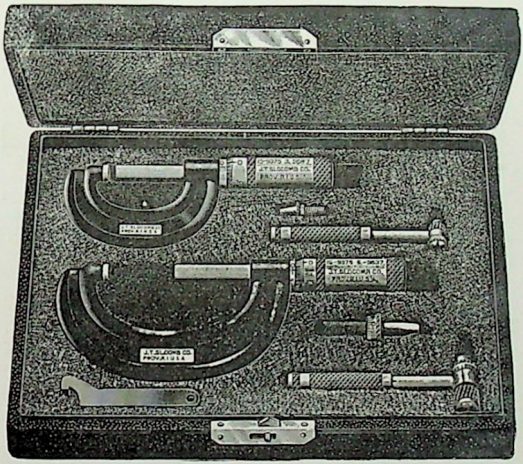


**Set No. 105**

This Micrometer set comprises the No. 102 inside micrometer together with No. 27 2 inch outside micrometer.

With genuine Morocco leather, velvet lined case, complete . . . . . $9.00

## MICROMETER CALIPER SET

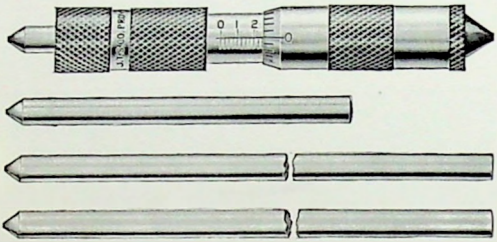


**Set No. 106**

This Micrometer Caliper set comprises the No. 101 and No. 102 inside micrometers, the No. 25 and No. 27 outside micrometers. This set will measure inside diameters from ½ inch to 2 inches and outside diameters from 0 to 2 inches. Full description of the inside caliper will be found on pages 95 and 96, Measuring Book, at the end of this catalog.

With genuine Morocco leather, velvet lined case, complete. . . . . **$18.00**

## INSIDE MICROMETER GAUGE

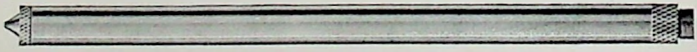


### No. 11

This Caliper is intended to measure inside diameters above 2½ inches. The micrometer screw has a range of ¼ inch and is graduated to thousandths of an inch. The four extension rods that accompany this caliper are ⅜ inch diameter and are held by split clamp chuck in any desired position. These rods are not graduated, the caliper being intended for comparisons, for making small allowances in making fits, etc. The rods furnished measure to 9 inches.

Price, complete as illustrated . . . . . **$1.75**

## MICROMETER GAUGE EXTENSION



### Nos. 1 and 2

These extensions are for use in connection with our inside micrometers and combination gauges, and are made so as to screw on to the end of the micrometer. For lengths greater than 9 inches they are much better than long rods.

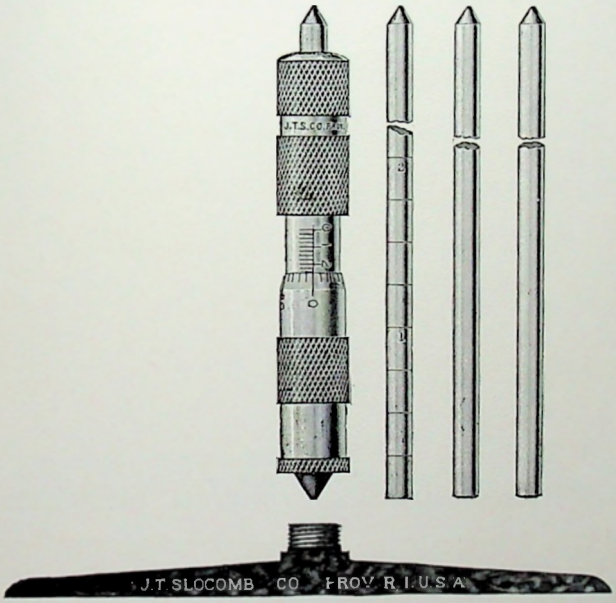
They can be made of any length but for the matter of convenience we list two lengths which we carry in stock. Any others we can furnish at special prices when desired.

A long rod is furnished with each extension tube which will run through the micrometer and also the extension tube as far as the pointed tip.

No. 1. Extension is 6½ inches long, and in use with micrometer will measure from 9 to 16½ inches. Extension complete, with steel tip and rod . . . . **$1.00**

No. 2. Extension is 14 inches long, and in use with micrometer measures from 16½ to 32 inches. Extension complete, with steel tip and rod . . . . . **1.25**

## COMBINATION MICROMETER GAUGE

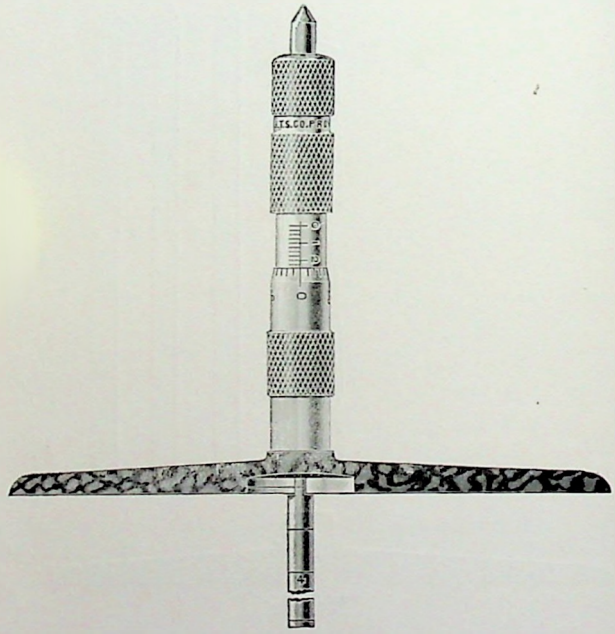



### No. 12

The Micrometer body and three plain rods are the same as in our Inside Micrometer Gauge, but the fourth rod is graduated, as shown, in ¼ inch divisions for use with the depth gauge attachment. It measures standard as a depth gauge, but only allowances or differences as an inside Caliper. The tip shown at lower end of caliper screws out and the depth gauge base screws in its place. Then by pushing the rod down through this base the depth gauge is made.

| | |
|---|---|
| No. 12. Combination Micrometer Gauge with Micrometer body, base, three plain rods, 2, 3½, and 5 inches long, and one rod 6½ inches long graduated to ¼ inch for 4 inches for Depth Gauge. Complete | $2.50 |
| Above, complete in Morocco case | 3.25 |
| Rod graduated to 6 inches for Depth Gauge | .40 |
| Rod graduated to 12 inches for Depth Gauge | .80 |

## COMBINATION MICROMETER GAUGE



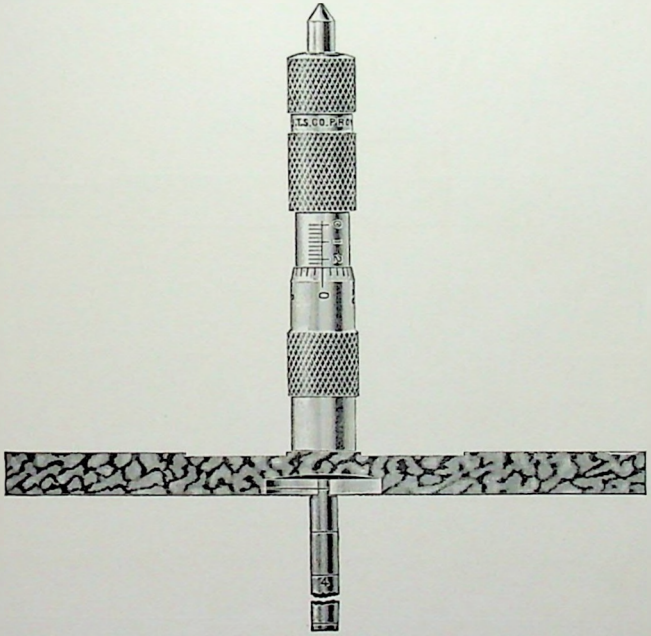
### No. 13

This tool differs from Combination Micrometer Gauge No. 12 only in the graduated rod and line in base to match, the object being to produce most particularly an accurate and convenient depth gauge.

The graduated rod has lines running completely around. It must be fitted to the base in which it is used.

| | |
|---|---|
| No. 13. Combination Micrometer Gauge with Micrometer body, base, three plain rods, 2, 3½, and 5 inches long, and one graduated as described above for 4 inch Depth Gauge. Complete . . . . | **$3.50** |
| Above, complete in Morocco case . . . . . | **4.25** |
| Rod for 6 inch Depth Gauge, graduated as above . . | **1.00** |
| Rod for 12 inch Depth Gauge, graduated as above. . | **1.50** |

## COMBINATION MICROMETER GAUGE

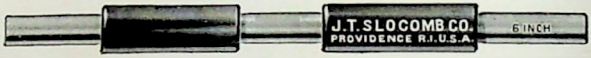


### No. 14

This tool differs from Combination Micrometer Gauge No. 13 only in its parallel base, which allows of its being used inverted, so as to measure standard heights (as well as depths) above ¼ inch, which is the thickness of the base. The base is hardened and accurately ground on both top and bottom. This tool will be found of value in adjusting planer tools, as it covers about all the ground of a step-height gauge, also measuring all intermediate sizes by thousandths, and to the length of graduated rod. For use as a height gauge on planer work, the body of micrometer can be dropped through a hole in planer platen, or be allowed to overhang the edge of platen or work. The graduated rod must be fitted to the base in which it is used.

| | |
|---|---|
| No. 14. Combination Micrometer Gauge with micrometer body, base, three plain rods, 2, 3½, and 5 inches long, and one rod graduated to ¼ inch for 4 inch Depth Gauge. Complete . . . . . | $4.50 |
| Above, complete in Morocco case . . . . . | 5.25 |
| Rod for 6 inch Depth Gauge, graduated . . . . . | 1.00 |
| Rod for 12 inch Depth Gauge, graduated . . . . . | 1.50 |

# STANDARD END MEASURES


These End Measures are particularly designed for testing micrometers and keeping them properly adjusted.

Sizes to 12 inches inclusive are made from tool-steel, .310 diameter, large sizes, 5/16 inch diameter. Ends are carefully hardened, ground, and lapped to the highest accuracy. To avoid changes in temperature due to handling, the rods are protected by non-heat-conducting covers as illustrated.

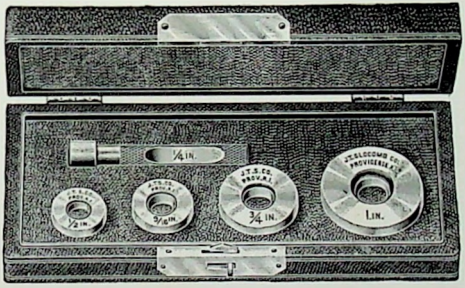
These same end measures are furnished with sets Nos. 20, 22, 24, 26, and 28, as listed on pages 39 to 43 inclusive.

### Metric Measure

We furnish, when so instructed, end measures to Metric measure at same prices as English.

| English Measure | Metric Measure | Price | English Measure | Metric Measure | Price |
|---|---|---|---|---|---|
| 1 inch | 25 mm. | $0.75 | 13 inch | 325 mm. | $3.25 |
| 2 inch | 50 mm. | 1.00 | 14 inch | 350 mm. | 3.50 |
| 3 inch | 75 mm. | 1.20 | 15 inch | 375 mm. | 3.75 |
| 4 inch | 100 mm. | 1.40 | 16 inch | 400 mm. | 4.00 |
| 5 inch | 125 mm. | 1.60 | 17 inch | 425 mm. | 4.25 |
| 6 inch | 150 mm. | 1.80 | 18 inch | 450 mm. | 4.50 |
| 7 inch | 175 mm. | 2.00 | 19 inch | 475 mm. | 5.00 |
| 8 inch | 200 mm. | 2.20 | 20 inch | 500 mm. | 5.50 |
| 9 inch | 225 mm. | 2.40 | 21 inch | 525 mm. | 6.00 |
| 10 inch | 250 mm. | 2.60 | 22 inch | 550 mm. | 6.50 |
| 11 inch | 275 mm. | 2.80 | 23 inch | 575 mm. | 7.00 |
| 12 inch | 300 mm. | 3.00 | 24 inch | 600 mm. | 7.50 |

## STANDARD REFERENCE DISC SET




No. 80

This set comprises the ¼, ½, 5/16, ¾, and 1 inch Standard Reference Discs. After long use a micrometer caliper or other gauge is often worn to some extent and will then need correct adjusting. This set is particularly useful in testing small micrometers and other small gauges.

With genuine Morocco leather, velvet lined case as illustrated . . . . . **$6.00**

## STANDARD REFERENCE DISC SET


## No. 81

The discs in this set are made of high grade tool-steel—hardened very hard, and finished to the highest accuracy. They are intended for reference for testing micrometer calipers and other gauges. The set consists of 29 sizes, ¼ to 2 inches inclusive, by 1/16 inch. The first two sizes are made solid with handle attached, and there are four detachable handles for the larger sizes. Discs from 9/16 to 1¼ inches are ¼ inch thick, 1 9/16 to 2 inches are 5/16 inch thick.

When purchased in sets they are furnished in a genuine Morocco-covered case, lined with velvet. Steel plugs attached to bottom of case support each disc, and each plug is stamped on top with size to correspond with size of disc to be kept in that place. In this way each disc is plainly in view and ready for use.

Price of Set, complete . . . . . **$32.00**

**Prices of Single Discs**

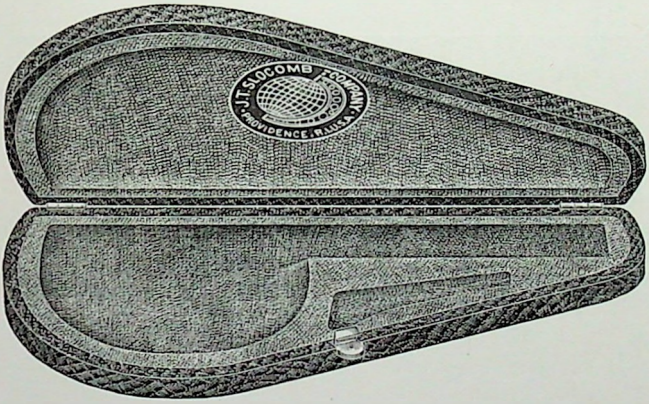
| | | | |
|---|---|---|---|
| *¼ in. ..... $1.50 | ¾ in. ..... $1.05 | 1 7/16 in. ..... $1.10 | 1 5/8 in. ..... $1.40 |
| *5/16 in. ..... 1.50 | 13/16 in. ..... 1.05 | 1¼ in. ..... 1.10 | 1 11/16 in. ..... 1.40 |
| 3/8 in. ..... .90 | ⅞ in. ..... 1.05 | 1 9/16 in. ..... 1.25 | 1¾ in. ..... 1.40 |
| 7/16 in. ..... .90 | 15/16 in. ..... 1.05 | 1 3/8 in. ..... 1.25 | 1 13/16 in. ..... 1.55 |
| ½ in. ..... 1.00 | 1 in. ..... 1.10 | 1 7/16 in. ..... 1.25 | 1⅞ in. ..... 1.55 |
| 9/16 in. ..... 1.00 | 1 1/16 in. ..... 1.10 | 1½ in. ..... 1.25 | 1 15/16 in. ..... 1.55 |
| 5/8 in. ..... 1.00 | 1⅛ in. ..... 1.10 | 1 9/16 in. ..... 1.40 | 2 in. ..... 1.55 |
| 11/16 in. ..... 1.00 | | | |

Sizes marked * are furnished with handles.

**Prices of Handles**

| | | | |
|---|---|---|---|
| 3/8 to ½ in. ... $0.65 | 9/16 to 5/8 in. ... $0.65 | 11/16 to 1 in. ... $0.75 | 1 1/16 to 2 in. ... $0.75 |

## NEW STYLE MICROMETER CASES

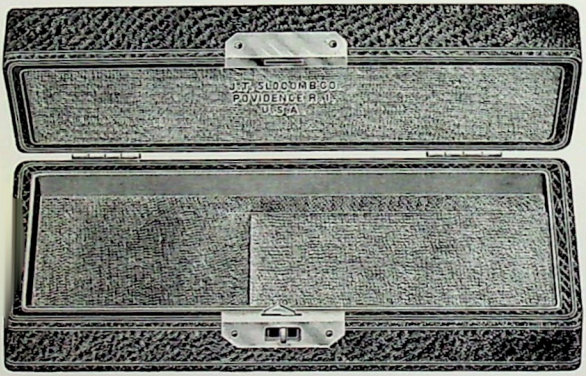



Many wish to carry a micrometer in their pocket and yet find it inconvenient to do so as the cases that have been on the market so many years are so bulky as to make it almost impossible; and, if the tool is carried loose, it is far more apt to accumulate dirt and dust. The new style cases listed on this page are designed to overcome this, as even the three inch case can be carried in the pocket with ease. Even though the cases are kept in the tool chest, they are of advantage because of taking up so little space.

Cases are lined with velvet and leather covered.

| | |
|---|---|
| No. 40. For ½ inch Micrometer . . . . . | **$0.50** |
| No. 41. For 1 inch Micrometer . . . . . | **.75** |
| No. 42. For 2 inch Micrometer . . . . . | **1.00** |
| No. 43. For 3 inch Micrometer . . . . . | **1.00** |

## MOROCCO CASES




These cases are genuine Morocco covered, lined with velvet and made for service. They are intended to contain single micrometers from 1 inch to 6 inch. The No. 18 and No. 21 are for 3 inch sets as illustrated on pages 36 and 37.

| | |
|---|---|
| No. 61. For 1 inch Micrometers | **$0.75** |
| No. 62. For 2 inch Micrometers | **1.00** |
| No. 63. For 3 inch Micrometers | **1.00** |
| No. 64. For 4 inch Micrometers | **1.75** |
| No. 65. For 5 inch Micrometers | **2.00** |
| No. 66. For 6 inch Micrometers | **2.25** |
| No. 18. For 1, 2, and 3 inch Micrometers, upright | **1.25** |
| No. 21. For 1, 2, and 3 inch Micrometers, flat | **1.25** |

## Semi-High Speed Steel Combination Center Drill


### Center Drills

We were the first to manufacture and market this tool (in 1891) and have felt and continue to feel particularly interested in making our center drills the best possible.

Slocomb Drills are made of semi-high speed steel, which is a Tungsten alloy combining great strength and cutting qualities. This steel is made especially for our use in these tools. The small sectional cut, Fig. 2, illustrates the section of a Slocomb Drill point. Thickness of web to *A* in center of drill is uniform as far as the grinding ever goes, then thickens rapidly so as to give great strength. Our Combination Center Drills always insure plenty of clearance for point of lathe center and correct

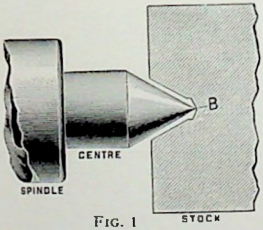



FIG. 1

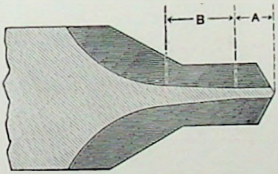



FIG. 2

angles. A center bearing on the extreme point as illustrated in Fig. 1 has caused and always will cause spoiled and bad work. Our combination center drills are your guarantee against such trouble. The pressure on drill point and the drill generally steadies the reamer or countersink so better work results than where a separate drill and countersink is used.

Slocomb Combination Drills can often be used to advantage in drilling and countersinking at one operation for wood and machine screws, for carriage and other kinds of bolts, in fact anywhere where large numbers of countersunk holes are required at a low cost.

For list of Combination Center Drills, see next page.

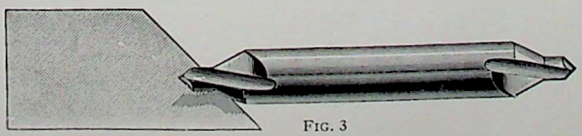


FIG. 3

Fig. 3 represents a Combination Center Drill starting a hole at quite a sharp angle to the surface. In our experience in light tool making, we have found these drills of much value for such work. When the small drill gets fairly started, it acts the same as the teat on a counterbore and prevents the countersink running off, so when the hole is countersunk sufficiently to allow the large drill to enter, that drill will start properly.

## Semi-High Speed Steel Combination Center Drill


| Number | Diameter of Body | Diameter of Drill Points | Decimal Diameter of Drill Points | | Price Per Dozen |
|---|---|---|---|---|---|
| S | 1/8 | No. 57 | .043 | | $2.00 |
| *H | 5/32 | 3/64 | .046 | | 2.00 |
| M | 13/64 | No. 55 | .052 | | 2.25 |
| L | 13/64 | 1/16–No. 45 | .062 | .082 | 2.25 |
| *E | 13/64 | 1/16 | .062 | | 2.25 |
| O | 15/64 | No. 49–No. 45 | .073 | .082 | 2.50 |
| *D | 15/64 | 5/64 | .078 | | 2.50 |
| *A | 3/16 | 3/32–1/8 | .093 | .125 | 2.75 |
| *B | 3/16 | 1/8 | .125 | | 2.75 |
| *C | 3/16 | 3/32 | .093 | | 2.75 |
| *F | 7/16 | 5/32 | .156 | | 3.50 |
| *G | 7/16 | 3/16 | .187 | | 3.50 |
| R | 7/16 | 5/32–3/16 | .156 | .187 | 3.50 |

*Those drills marked with an asterisk (*) before the letter are sizes which we have found to be the best, and these sizes we recommend.


| Number | Diameter of Body | Diameter of Drill Points | Decimal Diameter of Drill Points | Price Per Dozen |
|---|---|---|---|---|
| 1 | 1/2 | 7/32 | .218 | $4.60 |
| 2 | 1/2 | 9/32 | .281 | 4.60 |
| 3 | 1/2 | 11/32 | .343 | 5.00 |
| 4 | 1/2 | 13/32 | .406 | 5.00 |
| 5 | 5/8 | 7/32 | .218 | 7.25 |
| 6 | 5/8 | 9/32 | .281 | 7.25 |
| 7 | 5/8 | 11/32 | .343 | 7.75 |
| 8 | 5/8 | 13/32 | .406 | 7.75 |
| 9 | 3/4 | 1/4 | .250 | 9.50 |
| 10 | 3/4 | 5/16 | .312 | 9.50 |

**These Combination Center Drills should be run at a speed suitable for the drill regardless of the countersink.**

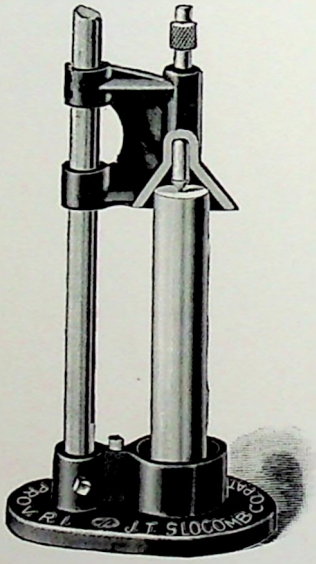
## MACHINISTS' SETS

### Semi-High Speed Steel Combination Center Drills


This Center Drill set as illustrated above comprises one drill each, *A*, *B*, *C*, *D*, *E*, *H*, *F*, and *G*, all combined in a neat and substantial wood box with close fitting cover. This is a valuable set for a Machinist's or Toolmaker's individual kit.

Price, complete as illustrated . . . . . **$2.00**

## SEVERANCE CENTERING TOOL




The Severance Centering Tool, in connection with our Combination Center Drills, makes a very good means of centering small lathe work. When stock is cut off so that the ends are fairly true, this centering tool will do accurate and rapid work.

They are made in one size, covering diameters from 5/16 to 1½ inches, and lengths to 12 inches.

The bell center punch is arranged to slide on the splined upright, and is prevented from turning by a key, set in its bore, which fits the spline in the upright. A small, rubber plug is inserted in a hole in the base-plate for the sliding head to drop on.

Price . . . . . **$2.00**

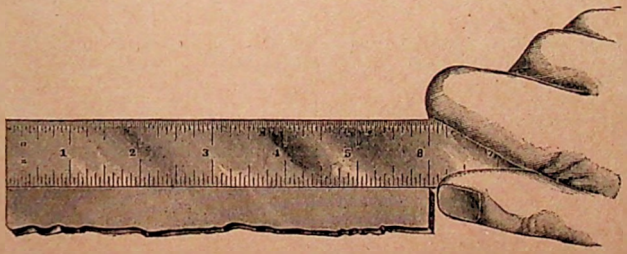
## ELECTROTYPES

We are constantly advertising in the best trade papers We have not missed an issue of the *American Machinist* in the past twenty years or in *Machinery* since it was first published.

It is always our endeavor to acquaint mechanics with the merits of Slocomb tools. Dealers can turn this publicity to their own account by local advertising.

We are glad to furnish new electrotypes from any of the cuts in this catalog and can furnish some reduced to the width of an ordinary reading column (2¼ inches).

# THE MEASURING BOOK



WITH SUGGESTIONS IN REGARD TO ACCURATE AND ECONOMICAL MEASURING IN MACHINE CONSTRUCTION

BY THE USE OF

## MICROMETER CALIPERS

## Our Building

is of particularly heavy construction designed specially for our work.

The character of our tools and the great accuracy required in their manufacture suggested the most substantial type of construction to eliminate as far as possible all vibration.

It is complete in all details and equipped with every modern appliance. Our machinery is largely special in character and of our own design, built with the idea of producing the greatest possible accuracy in our Measuring Tools and Comparators, etc.

Our lathes for cutting Micrometer Screws represent the highest mechanical attainments and are the best that can be produced.

## Our Claims

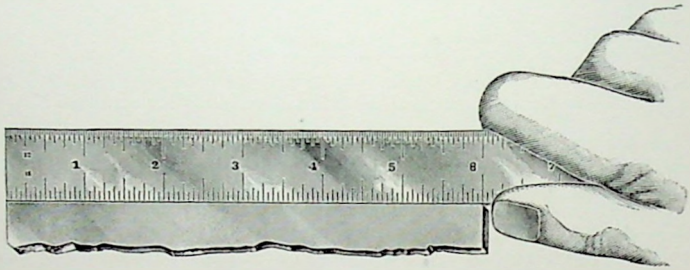
Without hesitancy we claim to manufacture the most accurate and long lived Micrometer Calipers.

We guarantee our product in every particular, and are thoroughly familiar with every detail of our manufacture, with an experience of twenty-four years. Our ability is devoted to just two lines, Micrometer Calipers and Combined Drills and Countersinks.

We also claim the largest and most complete plant for the manufacture of these two lines, and are therefore prepared to furnish what you require — accuracy.

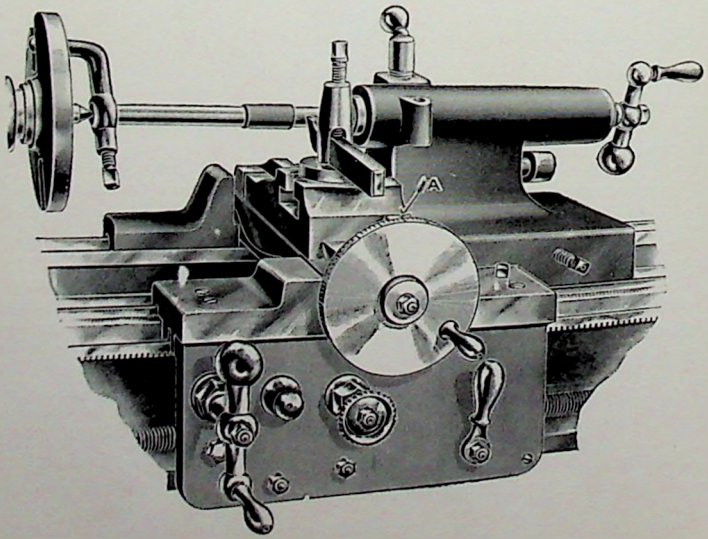
Our Micrometer Calipers are regarded as the standard everywhere by the best mechanics. Our type is our own.

Combined Drills and Countersinks were developed and put first on the market by ourselves and are to be found in every shop.



## Using a Common Rule

In measuring with an ordinary rule as shown above we not only know that the piece measured is the size wanted, but can know how much larger or smaller. When the machinists' trade was in its infancy, such measuring was in common use, but it did not prove fine enough for a large part of the work; consequently, the solid gauge or ordinary caliper was adopted.



**Graduated Dial Lathe Cross Screw**

This solid gauge provided a means of gauging more accurately than the common rule, but it lost entirely the feature of *measuring*; that is, the workman has no way with the solid gauge of knowing how near he is to the size, until the exact size is reached. This difficulty led to the adoption of the limit gauge. A limit gauge, as commonly made, has two sizes, one marked "To go on," the other marked "Not to go on," so that somewhere between these two sizes is the size required. This is much better than the single gauge, but it is a very incomprehensive way of measuring; besides, where these limit gauges are carried out to fill all requirements, the system is very complicated, as it requires thousands of such gauges, and such a complete set is very expensive. What the machinists require is a rule that can be used practically the same as the common graduated rule that will show when the exact size is reached, and also how near at any stage of the work, and show this in a way that is accurate. Such a tool is found in the micrometer caliper. A very common error in using a micrometer is in setting it to some particular size and locking the spindle fast, then using it like a snap gauge. In such a way it is only a solid gauge, and loses, practically, all its valuable features. The way to properly use a micrometer is to first become familiar with its reading so the exact size can be read quickly; then in every case measure the work with it, that is, whatever the work is, screw the caliper down to it and take its reading.

## Graduated Dial on Lathe Cross Screw

To make the best use of micrometers, all the adjusting screws on machines should be provided with graduated dials reading in thousandths. The illustration on page 66 shows the dial we use on small lathes. The quill is turned up straight for about 1¼ inch, and the pointer is mounted on this by split clamp, so it can be moved to make the zeros coincide when desirable. Usually we do not move this pointer, but make calculation between graduations. It is not necessary that the screw be absolutely accurate to pitch, as the adjustments necessarily made by this dial are small, so a slight error is not harmful; also backlash in screw is not fatal as this can be taken up before reading is started on dial. To turn to a accurate size, first round up the work, then measure with micrometer, after which make necessary adjustments by dial, being sure to be on safe side. Turn down first to about 5 or 10 thousandths of size. The last 5 thousandths can be adjusted accurately by dial, even if screw is not very accurate. This avoids the common "cut-and-try" method with its consequent loss of time and spoiled work. The thing of course required is, that the user becomes accustomed to the dial, so that he makes his calculations quickly and accurately. Besides using to adjust for sizes, this dial is useful for other purposes, as in adjusting lathe for turning tapers, alignment of centers, gauging cuts in cutting screw threads, and many other cases too numerous to mention. For the longitudinal movement we use a micrometer head fitted in a bracket that is clamped on the ways of lathe. This is a most useful tool for adjusting side cuts accurately.

The cuts below illustrate dials used on shaping machines. Fig. 3 and Fig. 4 are of dial used on table feed screw. This is simply a *cast iron* disc, with plain bore and split as indicated, so that it makes a spring fit on hub. In this case we use a stationary pointer, and turn dial to make zeros coincide. This is a cheap and handy dial. On the vertical feed screw, the dial is fitted on a taper quill, the pointer being stationary, and dial is moved by raising it slightly off its seat, and dropping it back again when the zeros coincide. The pointer used is simply a tap screw, with one side of head flatted off to correspond with angle edge of dial, with straight line cut across to match with lines on dial.

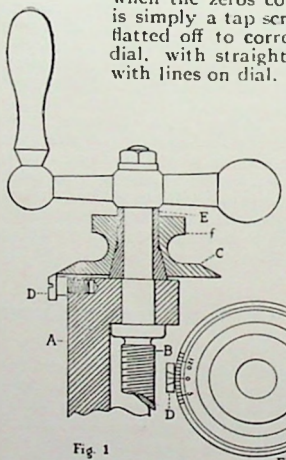



Fig. 1 Fig. 2

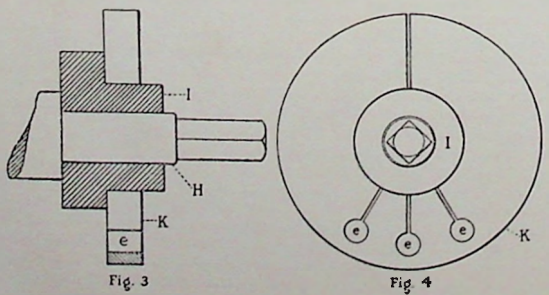



Fig. 3 Fig. 4

**Dials Used on Shaper**

These dials we have used for many years. Our men have become used to them, and they have proved great time savers. We find the following article in the *American Machinist* of January 28, 1915, and have its permission to use it here: —

If dials on the cross-feeds were graduated to read the diameters of the piece in the lathe instead of being graduated to indicate the amount the tool is advanced, we would get rid of some of the figuring and would know the diameter by inspection of the dial instead of repeated use of the micrometer. This advantage can be obtained by placing twice as many graduations on the circumference of the dial as there are thousandths of an inch in the lead of the screw and advancing the figures on the dial in a clockwise direction instead of counterclockwise as is now universally done.

### The Dial on a 20-Thread Feed-Screw

A front view of a diameter-measuring dial for a cross-feed left-hand screw having a lead of 0.050 inch is shown in Fig. 1, Page 70. One turn of the screw advances the tool 0.050 inch, representing a change of diameter of 0.100 inch. Thus the dial is divided into 100 parts, each representing 0.001 inch on the diameter.

Place a ¾-inch bar of steel to be turned to 0.625 inch in a lathe fitted with this dial; take a cut and then measure. The micrometer reads 0.6735 inch. The 0.6 is represented by whole turns of the screw and may be ignored, so the dial is set to 0.0735 inch, as shown in Fig. 2, the exact size the micrometer reads above the tenths and the inch. Advance the tool until the dial reads 0.050 inch and measure the piece with the micrometer. The size is found to be 0.650 inch. We are now sure of our ground and boldly advance the tool until the dial indicates 0.025 inch, as shown in Fig. 3, and cut with that setting. On measuring we find the diameter of the piece to be 0.625 inch, just what the dial indicated. Provided the tool point is level with the center, we can proceed to turn pieces having steps, shoulders, etc., referring only to the drawing and occasionally checking the dial setting for wear of tool or spring of work. The lathe for the time being acts as a micrometer, and we do not have to cover it with memoranda in chalk and keep on checking the figuring to see there is no mistake.

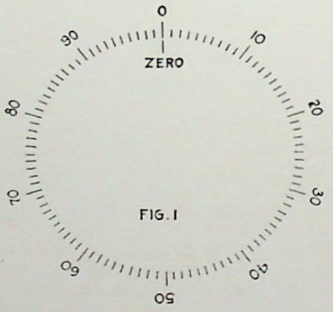
### Applied to Various Lead-Screws

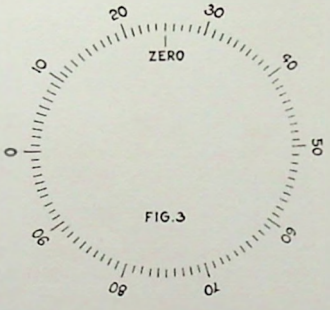
Cross-feed screws having 20 turns to the inch are, of course, limited to small lathes, but the diameter-reading dial can be applied to the larger lathes just as readily if the screws have ten or five turns to the inch. If the cross-feed left-hand screw has a lead of 1/10 inch, the dial will be graduated into 200 parts and numbered (clockwise as before) from 0 to 100 on one half, and this repeated for the other half. If the screw has a lead of 1/5 inch, the dial will have 400 divisions and be numbered 0 to 100 four times on the circumference.

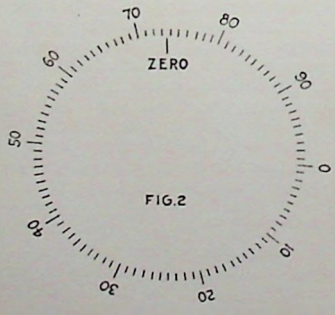
### The Dial on an 8-Thread Lead-Screw

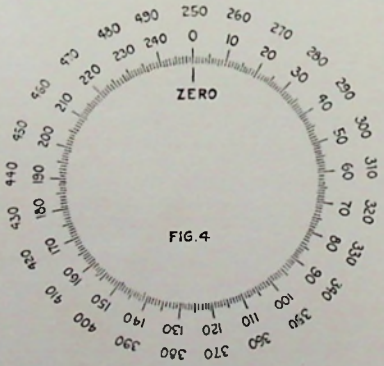
Most lathes have cross-feed screws with a lead of ⅛ inch, and while the numbering and reading of dials on them is not so convenient as the above, it can be done as shown in Fig. 4. This dial has 250 divisions and is numbered clockwise from 0 to 250 in one turn. The figures are then

carried on from 250 to 500 on another circle more remote from the graduations. In working with such a dial the inches and half inches have to be ignored. For example, I have in the lathe a piece 4 inches in diameter to be turned down to 3.875 inches diameter, tool finish. I take a cut, and on measuring find the size to be 3.913 inches. I ignore the 3½ inches and set the dial to .413 inches. Turning the cross-feed screw till the dial indicates .375 inches, I take a cut and find the diameter to be 3.875 inches.



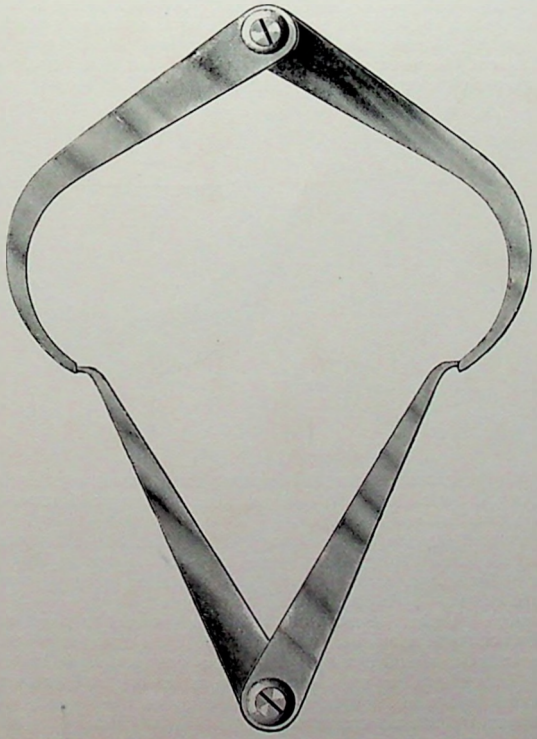

**Micrometer Dials on Lathes**

In this case I have to subtract 0.500 inch from the size my micrometer reads and have to keep in mind that the dial does not read the size of my job when the odd half inches have to be taken into account. However, half-inch errors are quickly located; it is the odd thousandths that bother us most.

In boring holes, too, this system of dial numbering is just as effective. A trial cut is taken, the hole measured and the dial set to that size. It will be seen that as the tool is fed out and the hole enlarged, the dial continues

to read the size of the hole, thereby eliminating the necessity of readjustment.

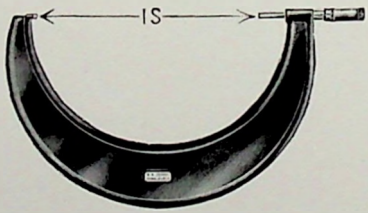
Using dials in this way it will be noted that with fine 20 pitch screws, graduations are fewer and coarser and the reading is simplified. Adjusting screws on large machines are made coarse to enable quick traverse in the various manipulations. In connection with this method of tool adjustment we suggest as an improvement in machine tools an extra short screw adjustment in the thrust bearing, giving an advance of .050 per revolution so that quick, long adjustments can be made in the regular way and fine short dial adjustments by the auxiliary screw. This auxiliary screw would then get little wear and would remain accurate for a long time.



**Old Calipers**

## Old-Fashioned Inside and Outside Caliper

The cut on page 71 illustrates the fitting together of an old-fashioned inside and outside caliper. Note that the points are small, and on account of the different angles of legs, it is impossible to shape these points so that they can have any considerable bearing. To match these calipers together so they will exactly fit is a delicate operation and requires some skill, a good deal of time and lots of patience. In view of the fact that the micrometer caliper can be used so much easier in this operation, this process nowadays seems to be the height of absurdity. Using an outside micrometer with its large parallel measuring surfaces, it is a very easy matter to adjust an ordinary inside caliper to the exact size. All that is required is to hold one point against the anvil of micrometer, and swing the other leg back and forth, finding the shortest distance. It is often the case that when the points touch, the user would like to know just how hard they touch; that is, how much spring there is to the caliper. This is easily ascertained


by turning the micrometer screw back one thousandth or more, and note if the points will touch at all in this position, proving the amount of error in the adjustment of inside caliper.

The difference between "about" and "is" is often the difference between success and failure. The "about" caliper has its use to-day, but that use is not in finishing work accurately. The shop that persists in such ancient methods to-day is on the road to failure.

The thousandth part of an inch has been found the most convenient unit for the accurate part of machine work. This unit lends itself readily to most calculations and is much more convenient to use than ordinary fractions. There are many times when micrometer accuracy is not necessary, but when it is found advisable to use the micrometer, the decimal measurements are convenient.

The following illustrations are offered as suggestions as to how micrometers may be used for various kinds of measuring.

Fig. 1 illustrates a part of a machine frame with two bores with fixed center distance *A*. A pair of spur gears are required to run in close mesh on these centers and it is required to know if the center distance as bored is correct. Place two lathe arbors in the bores so that they extend as shown. Then measure across outside to outside with micrometer on line *B*, after which subtract from this measurement one-half the diameter of each arbor at the point where measurement is taken for exact center distance. In cutting a pair of gears to run nicely on this center distance, a few teeth only can be cut on each gear as illustrated. Then place the gears together and measure with micrometer over the two gears *C* as shown in Fig. 2. Then subtract from this measurement one-half the diameter of each gear blank for exact center distance. Of course a suitable allowance will have to be made for running clearance, but this is easily made with the micrometer.

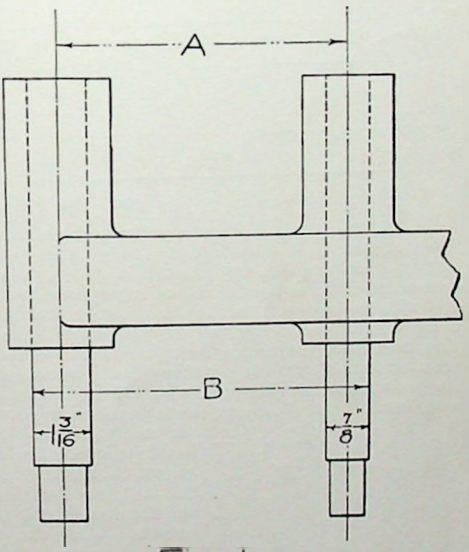



Fig. 1.

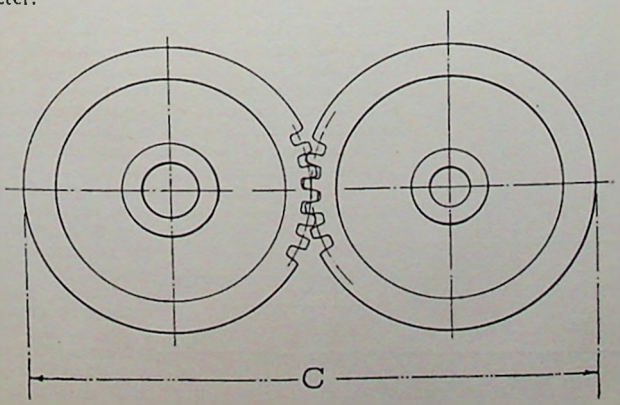



Fig. 2.

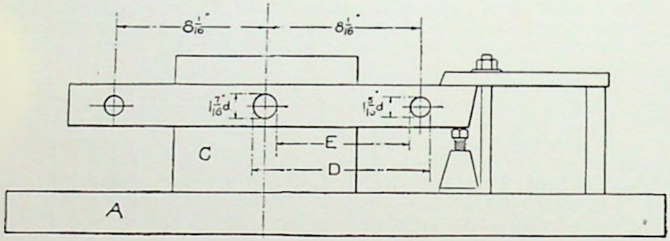



Fig 3

Fig. 3 illustrates the boring of the three hole jig *B* so that the holes are equi-distant. This work was done on the milling machine. The piece was first clamped to the knee *C* on the milling machine table *A* and the center hole bored by the use of a single point cutter in boring bar. Then a stud was fastened to the knee nicely fitting the center hole, a spot was trued up on the boring bar, by holding a lathe tool in the milling machine vise, and then the milling machine table was nicely adjusted by micrometer measurement from the outside of stud on knee to the outside of spot trued on boring bar, as illustrated by *D*, making of course the necessary allowance for half the diameter of stud and boring bar. Where more convenient, an end measure rod, made to micrometer, or inside micrometer, can be made to measure between as at *E*. After making the adjustment of table, it was locked fast, the work was then put in place as shown and the first end hole bored to size. Then the piece was reversed both end for end and opposite sides, so that the same edge of piece came down and the other hole bored at the same table setting. It will be seen that any number of holes can be bored to any center distances by the same plan. The holes were first rough drilled on a drill press.

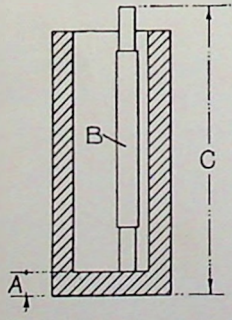



Fig. 4

Fig. 4 illustrates the accurate measuring of the bottom *A* of cup. This is accomplished by using the end measure *B* as shown, and taking measurement *C* with micrometer, then subtracting length of end measure rod.

Fig. 5 illustrates the measuring of steps *A* and *B*. (This, as well as the measurement in Fig. 4, can be taken by micrometer depth gauge, but is more accurately done by outside micrometer.) First measure the thickness *C*, then add step *B* for *D*, then add to *D*, step *A* for *E*.

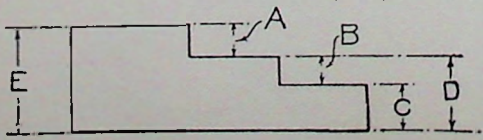



Fig. 5.

Figs. 6, 7 and 8 illustrate the fitting of the bronze hub *E*. This hub is used in a screw machine for the center bearing for turret. It is mounted on a taper stud and is fitted so that it bears on the taper tightly and at the

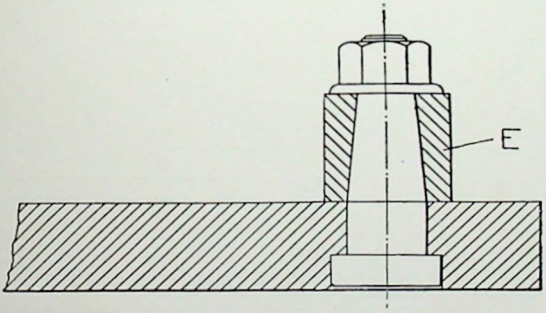



Fig. 6.

same time on the lower end. These were formerly fitted by the "cut-and-try" method, but a considerable saving of time was effected by measuring the distance *A*, Fig. 7, with micrometer. This was done directly by passing

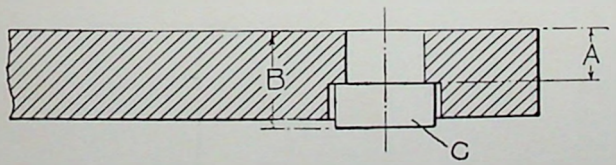



Fig. 7

the micrometer through the hole, but where the hole is not large enough it may be done by using the plug *C* and measuring over the measurement *B*, then subtracting out the plug *C*. After this measurement is taken it is transferred to an inside caliper. The stud with bushing pressed into place is then mounted on lathe centers as shown in Fig. 8 and the space *A* is faced up according to the measurement taken.

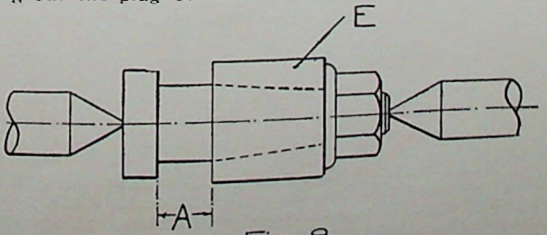



Fig. 8.

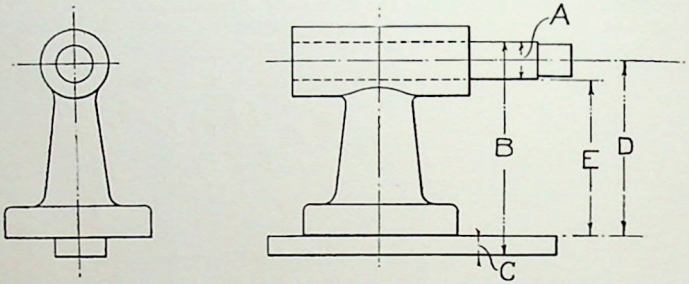



Fig. 9.

Fig. 9 illustrates the measuring of dimension *D*. This is accomplished by using the lathe arbor in the hole, and a small parallel against the flat base as shown, then measure dimension *B* and subtract one-half diameter of arbor and thickness of parallel *C*, or if more convenient, a rod can be made to micrometer measuring dimension *E*.

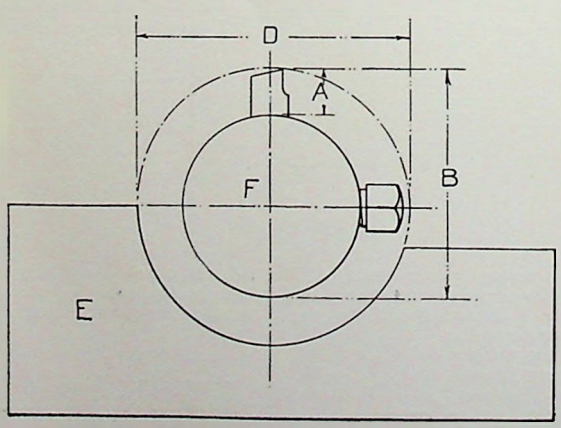



Fig. 10

Fig. 10 illustrates the boring with a boring bar of a segment of a circle. This segment *E* is less than half a circle, so it cannot be measured in the regular way. The boring bar *F* is made to run true on the lathe centers, and its diameter is measured with a micrometer. By subtracting one-half

the diameter of the boring bar from one-half the required diameter of the segment *E*, the overhang *A* of the boring tool is found. Now by adding this length *A* of the boring tool to the diameter of the boring bar gives the dimension *B*, which is easily measured across from back of the boring bar to the cutting edge of the tool with the micrometer, and so the adjustment is made to accurately cut the circle in segment.

Fig. 11 illustrates the measuring in milling, planing or grinding the square from a round. When this work is done with a dividing head on a milling machine, it is usually easy to get the size by a "cut-and-try" method, by taking alternate small cuts on opposite sides, but when the work is set up so it can not be readily indexed the micrometer can be used to advantage by flatting first one side to dimension *B*. This dimension of course is found by subtracting *A* from *C*, and *A* is found by taking half the difference between *C* and *D*.

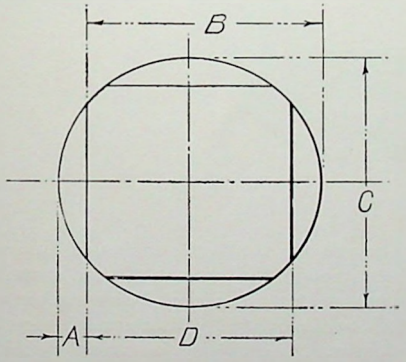
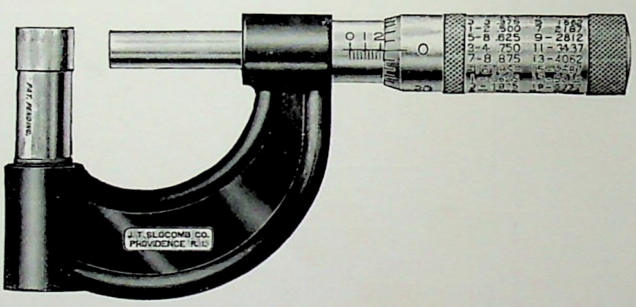



Fig. 11

# Tube Micrometer




In measuring the wall of a small tube or ring, we have a tube micrometer as illustrated above, but in the absence of such a special micrometer, a ball or plug can be used on the curved inside surface and measurement taken over the ball or plug, then its diameter subtracted for wall of ring. Steel balls are often used in this way in measuring ball races in making ball bearings, although we make special micrometers with ball points for such work, see page 35, catalog.

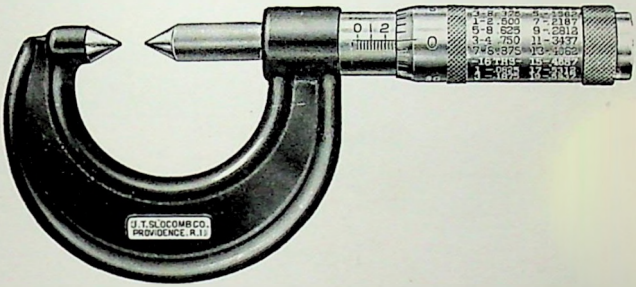
For measuring the wall of a tube or ring where the hole is large enough to permit, we furnish a regular micrometer with rounded anvil.

The micrometer illustrated above can be furnished to measure in a hole as small as .200 inch.

In boring for an inside screw thread the necessary allowance can be accurately made by the use of a micrometer. To illustrate: In cutting an internal thread 4 inches in diameter, 12 pitch U. S. Standard, the double depth of such a thread is .1082. We subtract .108 from 4 inches, leaving 3.892, proper size to bore for thread.

It is usually possible to accurately measure many kinds of work by some such methods as described.

# Screw Thread Micrometer Caliper

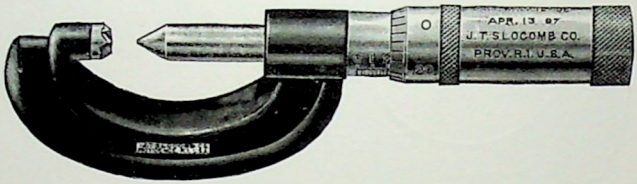



## No. 29

### Measuring Screw Threads

A great many mistakes have been made in cutting screw threads that might have been avoided by the use of screw thread micrometers. In fitting plain work, it has been almost the universal practice to make caliper fits and avoid as much as possible "cut-and-try" methods, but owing to the want of a suitable screw thread micrometer, screw threads have usually been fitted by the "cut-and-try" methods. In cutting threads in the lathe, it is often the case that the first thread will be somewhat thick on account of the tool springing off when cutting on one side only. Then the first thread in nut is liable to be turned in some way so in trying the nut on it is often thought to be too tight when the real trouble is the thick or turned threads. Then the work is reduced by mistake and the fit is often spoiled. Our No. 29 screw thread micrometer, as illustrated above, is a most useful instrument for such fitting. In cutting such screw threads, first measure the tap or screw thread standard with the No. 29 micrometer, then in cutting the outside thread, this measurement can be accurately duplicated, or if some allowance is required, this can be accurately made. As this No. 29 micrometer does not measure across diametrically opposite points, it is objected to by some, but we wish to call attention to the fact that it measures the work the same as the standard and for purposes of reference or comparison, gives accurate and reliable results. Such a caliper has a greater range of threads and is more easily used than the No. 30 screw thread micrometer which is described later.

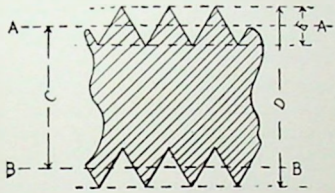
## Standard Screw Thread Micrometer




## No. 30

Many years ago, the fact was forced upon mechanics that some standard for screw threads was a necessity. Various attempts were made to establish such standards. Perhaps the first standard that came into prominence was the Whitworth. This was very carefully designed, but the designers failed to make any allowance for top and bottom clearance, that is the design calls for the top and bottom of threads fitting perfectly around a certain size radius, which would be an impossibility to make without going to extraordinary means and expense. Then again, without a proper instrument for measuring diameters, the whole system fell far short of being an interchangeable one. To avoid the expense in making such rounded top and bottom of threads, the U. S. Standard form of thread was devised, but in this there was no allowance made for top and bottom clearance and no means of measuring the diameters accurately. The old time method of cutting such threads was to finish the outside diameter accurately, grind the thread tool to the proper flat on end, then cut the threads down until the top looked the same width as the bottom, as there was no way of accurately measuring them. In the Slocomb Standard Screw Thread Micrometer, we find an instrument that measures the pitch diameter of the threads from the angle sides and not from the top or bottom. With this instrument it is possible to allow a proper top and bottom clearance in the threads, and at the same time make perfect fits on their angular sides and duplicate this measurement at any time or any place with accuracy. The Slocomb Micrometer is especially desirable for this work for the reason that all adjustments are on the spindle and we are, therefore, able to use a solid anvil which is more reliable than when this piece is fitted loose. This instrument can be made to measure any form of angle sided threads from the pitch line.

Referring to the small sectional cut, following page, *A* and *B* are the pitch lines of the thread and *C* is the measurement shown by these calipers. This is one depth of thread less than outside diameter. It will be seen that the only requirement is that the anvil and point of screw shall bear on the angle




sides of thread and not on the extreme top or bottom. Such calipers are somewhat limited in their range for the reason that the anvil must be fitted to the smallest thread and for the coarser threads it will not extend far enough down on the angle sides to make an accurate measurement. Then again, for Whitworth or U. S. Standard threads, the point of screw has to be flatted enough for the coarsest thread of its range. This prohibits its use on a thread so fine that the blunted point will not enter far enough to make a correct reading. It will be seen that for sharp V threads, such screw thread micrometers can have a greater range than for other forms of threads. For V threads one caliper with anvil fitted to 32 pitch will measure satisfactorily from 20 to 32. A caliper fitted to 20 pitch will measure from 16 to 20, a caliper fitted to 16 pitch will measure from 10 to 16, and another fitted to 10 will measure all coarser pitches.

Referring again to the different designs for screw threads, it is evident that with these screw thread micrometers to measure with, it is possible to still further improve on the design by providing a proper clearance at top and bottom of threads. As there is nothing to be gained by making a screw thread bear at top and bottom, why try to do it and why the extra expense?

In a U. S. S. thread it is a decided advantage to make the tap oversize on the outside diameter, leaving the top of thread flatted less than $\frac{1}{8}$ of the pitch and the bottom of thread flatted standard or $\frac{1}{8}$ pitch. This is not a new idea, in fact, something like this is a necessity on some kinds of work and has been in use for years, but is made more practical through the use of screw thread micrometers.

For U. S. S. Standard or other forms of threads where the top or bottom is flatted, a number of calipers are required on the finer pitches. For further information in regard to range, see page 29, catalog. The depth of a V thread is found by dividing the constant .866 by the pitch number of threads to the inch, and for a U. S. Standard, dividing .6495 by the number of threads. The table on following page will be found useful in connection with these screw thread micrometers.

## Constants for Use with J. T. Slocomb Company's Screw Thread Micrometer

Subtract from the outside diameter the constant for pitch and form of thread for the correct micrometer reading.

*Example.* To find thread micrometer reading for ½—13 *U. S. S.*
½ inch = .500. Constant for 13 *U. S. S.* thread is .0499.
.500 — .0499 = .4501 (thread micrometer reading).

| Pitch | V | U. S. S. | Whitworth | Pitch | V | U. S. S. | Whitworth |
|---|---|---|---|---|---|---|---|
| 40 | .0217 | .0162 | .0160 | 12 | .0722 | .0541 | .0533 |
| 38 | .0228 | .0171 | .0168 | 11½ | .0753 | | |
| 36 | .0241 | .0180 | .0177 | 11 | .0787 | .0590 | .0582 |
| 34 | .0255 | .0191 | .0188 | 10 | .0866 | .0649 | .0640 |
| 32 | .0271 | .0203 | .0200 | 9 | .0962 | .0721 | .0711 |
| 30 | .0289 | .0217 | .0213 | 8 | .1082 | .0812 | .0809 |
| 28 | .0309 | .0232 | .0228 | 7 | .1237 | .0928 | .0914 |
| 26 | .0333 | .0250 | .0246 | 6 | .1443 | .1082 | .1066 |
| 24 | .0361 | .0271 | .0266 | 5½ | .1574 | .1180 | .1163 |
| 22 | .0393 | .0295 | .0290 | 5 | .1732 | .1299 | .1280 |
| 20 | .0433 | .0325 | .0320 | 4½ | .1924 | .1443 | .1422 |
| 18 | .0481 | .0361 | .0355 | 4 | .2165 | .1624 | .1600 |
| 16 | .0541 | .0406 | .0400 | 3½ | .2474 | .1855 | .1828 |
| 14 | .0619 | .0464 | .0457 | 3¼ | .2664 | .1998 | .1969 |
| 13 | .0666 | .0499 | .0492 | 3 | .2886 | .2165 | .2133 |

A. S. M. E. is same as U. S. S.

### Formulas

Thread Micrometer reading for V threads $= D - \frac{.866}{P}$

Thread Micrometer reading for U. S. S. threads $= D - \frac{.6495}{P}$

Thread Micrometer reading for Whitworth threads $= D - \frac{.640}{P}$

Thread Micrometer reading for A. S. M. E. threads $= D - \frac{.6405}{P}$

## Special Features of the Slocomb Micrometer

The construction of this micrometer differs considerably from all othe
One of the most important improvements embodied, is in the adj
ment between the measuring screw and its nut. This is done by drav
the spindle back in line with its axis, which keeps all threads in con
and does not shorten the length of wearing surface, as when the adj
ment is made by pinching together one end of nut, as is usual. A
bearing on screw insures uniform wear. Large wearing surface, toget
with the hard stock the screws are made of, gives the Slocomb Micromete
a long life even under severe work.

The total area of surfaces in contact between one side of threads of screw and its nut is about ⅜ of a square inch, or about six times the area of face of anvil. It should be understood, in a tool where accuracy is so very essential, that its life and value depend upon the extent and nature of its wearing surfaces. A short bearing of the nut on measuring screw will wear the screw out of pitch. Besides these liberal wearing surfaces, the screw is made of *tool steel*, of as high temper as can be cut. *The Slocomb Micrometer is the only one with an all tool steel screw.* These hard screws resist wear and abrasion. The Slocomb Micrometer will remain accurate after long use.

Another valuable feature not found in other micrometers lies in the spring. This spring produces a slight uniform friction on the spindle, so it is never loose at any point and will not move around of its own accord. Incidentally this spring keeps the spindle back in its seat, and does not call for a rigid fit between spindle and nut with its consequent danger of roughing up and seizing.

The anvil is a tool steel plug, hardened and forced in frame, and is practically solid with the frame. The bearing supporting the plain part of spindle is a bushing and is easily renewed when worn.

The spindle is adjusted down to compensate for wear on anvil by turning the main nut. This is a differential screw adjustment and is very fine.

*We have improved lathes that cut the most accurate screws in the World.*

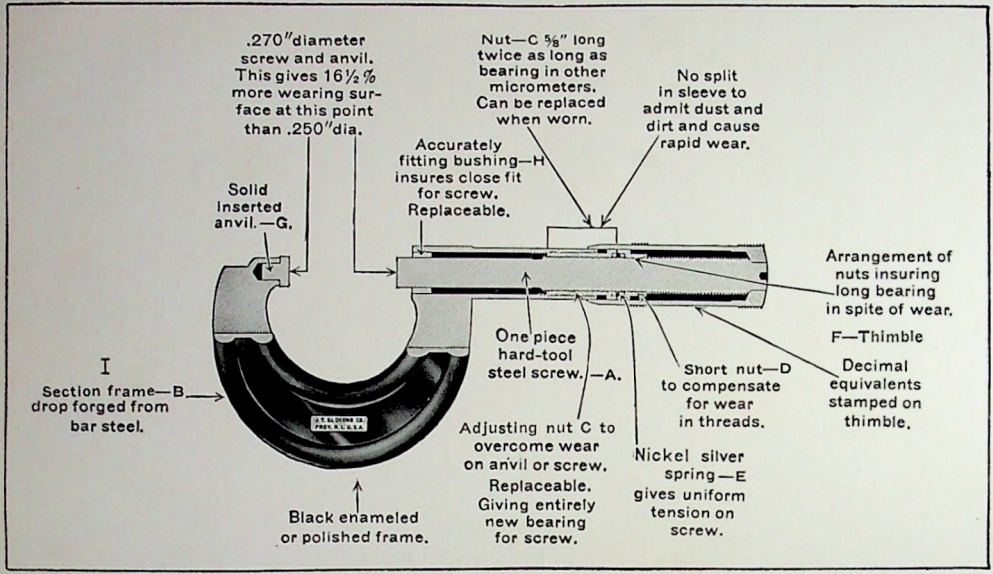
All frames to the 9 inch inclusive are drop forged from bar steel; larger sizes are steel castings.

These Tools are not an experiment.

They have been in use since 1894 in the best shops all over the World and have been thoroughly tested.

## Sectional Cut Micrometer

The illustration on page 84 represents a section through the Slocomb Micrometer. The spindle *A* is attached rigidly to thimble *F*. This spindle is threaded 40 pitch, and passes through main nut *C*, also is supported at *H* by bushing, which bushing is forced into frame *B*. The main nut *C* is threaded externally 32 pitch, and is a tight screw fit in frame *B*. Now, with parts in place as shown, turning nut *C* will advance spindle *A* the amount of difference in pitches between 32 and 40, or .006¼ per revolution. This is the adjustment for wear on measuring terminals that is


.270″diameter screw and anvil. This gives 16½% more wearing surface at this point than .250″dia.
Nut—C ⅝″ long twice as long as bearing in other micrometers. Can be replaced when worn.
No split in sleeve to admit dust and dirt and cause rapid wear.
Accurately fitting bushing—H insures close fit for screw. Replaceable.
Solid Inserted anvil.—G.
Arrangement of nuts insuring long bearing in spite of wear.
F—Thimble
I
Section frame—B drop forged from bar steel.
One piece hard-tool steel screw.—A.
Short nut—D to compensate for wear in threads.
Decimal equivalents stamped on thimble.
Adjusting nut C to overcome wear on anvil or screw. Replaceable. Giving entirely new bearing for screw.
Nickel silver spring—E gives uniform tension on screw.
Black enameled or polished frame.

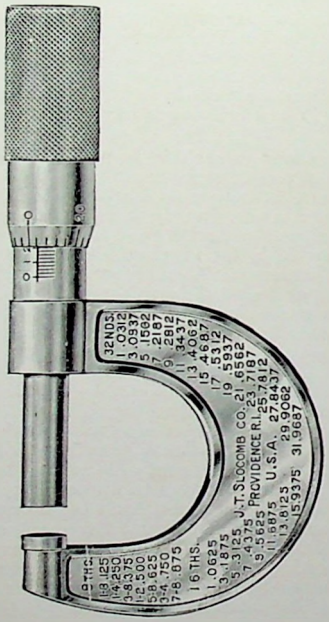
ordinarily done by adjusting an anvil screw. This is a decided improvement, as it allows of using a solid and substantial anvil, also provides a very fine adjustment; that is, it takes a considerable movement of nut *C* to make a small change in the adjustment. On the face of the nut *C* and nut *D* there are 56 V-shaped teeth milled, forming a clutch. In the recess between these two nuts there is a light coiled spring *E*. When these two nuts are clutched together, and spindle screwed through, it is impossible to separate them. This arrangement allows of two forms of adjustment for taking up wear in threads of screw. First, the rigid adjustment, which is done by advancing the small nut one or more teeth, and second, a flexible adjustment produced by spring *E*. After fitting these two nuts together, a line is cut outside, marking point where they are fitted. This construction also allows of making cheap repairs, in case o accident or extreme wear. By putting in new bushing *H* and main nut *C* the original alignment is restored.

Caution: to make adjustment, a spanner wrench is furnished fittin slot *e* in main nut *C*. In turning this nut the wrench should be held down firmly, so as not to slip and tear out slot, as these nuts start rather hard. To know exactly how much to turn the main nut, first measure an accurate standard and find the exact fraction of a thousandth that is needed for adjustment. For illustration: Suppose it is found that spindle needs adjusting down .000¼. As turning adjusting nut *C* one whole revolution advances spindle .006¼, then adjusting down .000¼ would mean turning nut 1/25 revolution, or the amount of one division of thimble. To do this turn thimble back until its end matches inside of slot on main nut *C* and one line corresponds with the left side of slot, when holding tool with thimble pointed away from the eye. Now, draw lead pencil mark on sleeve *B* to correspond with next line on thimble, after which turn thimble back sufficient to allow for using wrench and turn nut to the right, so that edge of slot corresponds with lead pencil mark. This is moving nut the amount of one division of thimble. For .000½ adjustment, turn the amount of two divisions, or for .001 adjustment, turn the amount of four divisions. By this method it is easy to adjust these micrometers to an accuracy of .0001 without making a second attempt. Sometimes, for inspection, a person who is not familiar with the construction will get the small nut detached, and lose it up inside of thimble. There is absolutely no occasion for this, as these nuts cannot be separated, except by running spindle back about ½ inch beyond last graduation, a thing that is never necessary to do except for inspection or repair. When this is done it is a very easy matter to match nuts according to line cut on outside and hold them together closely, until screw is entered in main nut, when they cannot be separated.

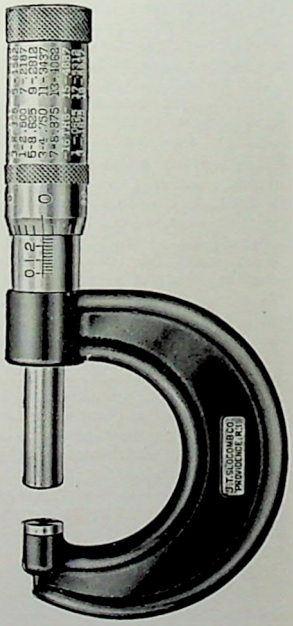
## Two Styles One-Inch Micrometer

Referring to the cuts, page 86, the one to the left represents a one-inch micrometer with pressed flat frame, and complete table of decimal equivalents, consisting of 8ths, 16ths, 32ds and 64ths, raised above the surface. The frames in these tools are drop forged, then polished, after which they are pressed in dies, consisting of two side members and a retaining ring. These dies are practically the same as used in coining money. That is,

the work is entirely confined in the die, so it cannot spread and must fill every part of die when sufficient pressure is applied. For this particular piece a pressure of three hundred tons is used. This work is done in a hydraulic press. These dies are finely polished, so that no further finish is required on side of frames after pressing.




No. 26

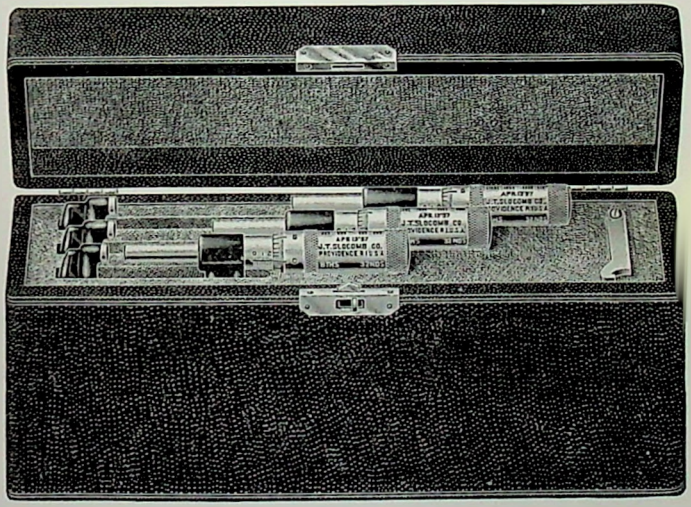



No. 25

The micrometer at the right has a frame drop forged to an I section, giving the greatest rigidity with least weight. Also this frame allows of easy handling, as the recesses make a very good finger hold. When the workmen's hands are oily, this aids in accurate measuring, as the tool can be handled more delicately. These frames are finished in black enamel. The thimble on this tool has a complete table of decimal equivalents, consisting of 8ths, 16ths and 32ds, rolled almost completely around same. In other respects this caliper is the same as the other.

## Micrometer Calipers in Sets

Many years ago the custom was quite general for the workman to buy all his own small tools. These tools were simple and inexpensive, and it was quite practical for him to do so. Later, more expensive tools were required, and the firms began to buy such tools as a part of the shop's equipment. A good outfit of micrometer calipers should be as much a part of the outfit of a modern shop as machine tools. These set cases provide means of properly taking care of the calipers. Sets with oak cases, provided with lock and key, are good where there is no tool room, and where the foreman



**No. 18 Set**

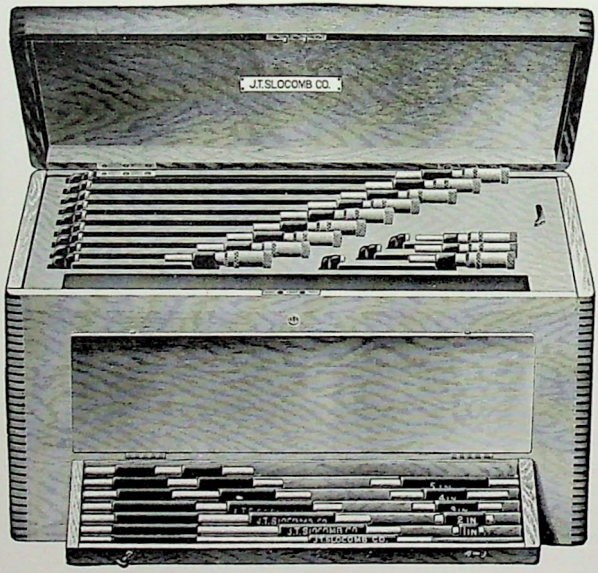
is obliged to care for these tools in the shop. For tool rooms the racks are more convenient.

The No. 18 and No. 21 Sets are intended particularly for the individual workman. The cases for these sets are covered with Morocco leather. These sets contain three micrometers only, a 1 inch, 2 inch, and 3 inch. See pages 36 and 37, catalog.

The No. 19 and No. 22 Sets have a substantial oak case, with lock and key. The No. 19 Set contains six micrometers from 1 inch to 6 inch inclusive. The No. 22 contains twelve micrometers from 1 inch to 12

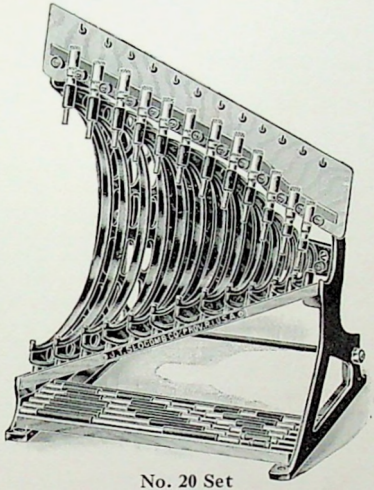
inch inclusive, together with a set of end measures from 1 inch to 12 inch. This set of end measures fits into a grooved small case, and this small case in turn fits into a slot in main box, as shown below.

The No. 20, No. 24, No. 26 and No. 28 Sets are intended for the tool room. The No. 20 Set consists of twelve micrometers from 1 inch to 12 inch and set of twelve end measures to correspond; the No. 24, six micro-




No. 22 Set

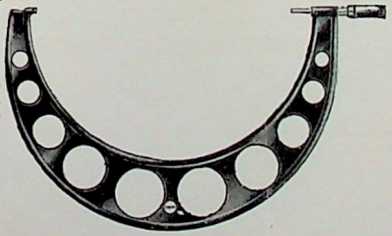
meters from 13 inch to 18 inch inclusive, with end measures; the No. 26, six micrometers from 19 inch to 24 inch, and the No. 28, twelve micrometers from 13 inch to 24 inch. The end measures fit in grooved slats in base of rack. At the top of these racks hooks are provided for the workman's check. The partitions in these racks, separating the different tools, are made by using rubber plugs, which are screwed to the wooden slats, as shown. The side-members of these racks are iron castings, nicely japanned. The slats are of oak, nicely finished.



No. 20 Set

## Micrometers from 9 to 24 Inches

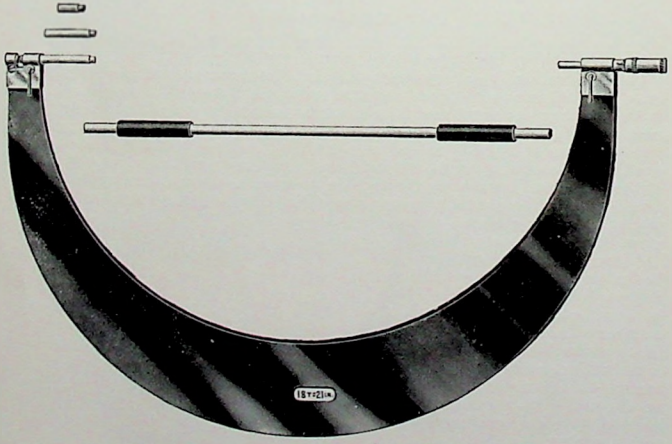
The illustration below represents a style of micrometer used in measuring from 9 to 24 inches. These calipers are made by steps of even inches, so that fifteen different tools are used to measure a range from 9 to 24 inches. The frames are cast of semi-steel, and finished in black enamel. The micrometer head is forced into the frame from the inside, and the anvil is made of the very best tool steel, hardened and forced into place. These tools are always ready and dependable and are much to be preferred over calipers with a larger range, fitted with attachments or loose pieces. In any shop of more than one man capacity, more than one caliper has to be provided to avoid delays. These micrometers, in sets, can be used by a number of men at the same time, which is not true of combination tools. Besides, in such tools accuracy must be dependable, and this is impossible in a micrometer with attachments.



Micrometer from 9 to 24 Inches

## Micrometer for Large Work

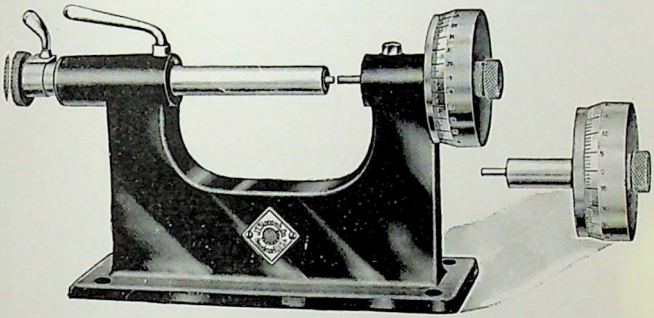
For very large work, say from 24 inches up, there is some economy in using micrometers with more than 1 inch range. By far the best micrometer of this description is shown in illustration. The three interchangeable anvils in this caliper are standard end measures, a 1 inch, 2 inch and 3 inch. They rest against an adjusting screw and are held by split clamp. A gap is provided so that contact between end measure and adjusting screw can be inspected. In pushing this anvil down dirt is liable to be forced ahead, and caught between the surfaces. In this tool it is a very easy matter to wipe between the surfaces with a piece of paper before making actual contact, and then hold to the light so as to make absolutely sure that the contact is good. With this caliper, one long standard end measure for testing between terminals is all that is required. The short anvil end measures can be measured with a smaller micrometer, so as to be certain of the accuracy of adjustment. In these large calipers a clamp is provided for locking the screw in any position. The frame on this caliper is finished in black enamel. These micrometers are made to 30 inches.



**Micrometer for Large Work**

## New Six-Inch Bench Micrometer

This machine has a range from 0 to 6 inches and is provided with two interchangeable measuring heads. One of these is graduated to read in ten-thousandths of an inch direct off the thimble, has a very accurate screw and is suitable for making gauges, or in any work where extra fine measurements are required. The other head has a 10 pitch screw, is graduated to

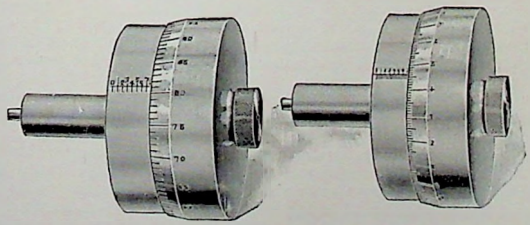


6-Inch Bench Micrometer

measure in thousandths of an inch, and is intended for work where rapid measuring is required to a degree of accuracy of one-quarter of a thousandth.

The thimble in both cases is 4 inches in diameter, making the graduations very coarse, and in the quick-acting head on account of the 10 pitch screw readings are direct; all that is required is to take the first figure from the sleeve and the other from the thimble. As shown in the enlarged cut, the reading is .781¼. The lines and figures are so large that readings can readily be made two or three feet away.

The anvil is made with sliding bar held by split clamp in the main bed or frame. This is for approximate adjustments and slides 5 inches.

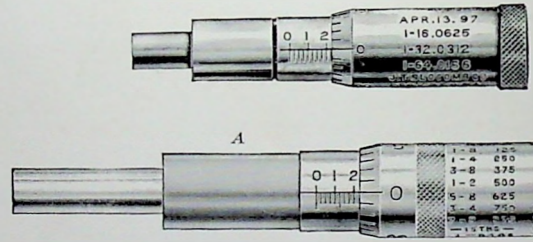


Interchangeable Measuring Heads for 6-Inch Bench Micrometer

Another adjustment is made through the center of this bar through the knurled head screw shown at the back end. There is a plunger in this bar held back against the adjusting screw by a coiled spring. There is a key fitted in the bar, and also another in this plunger, so that the anvil does not revolve. The large thimbles are made of aluminum for the sake of lightness.

The head with the 10 pitch screw makes a very useful caliper for the tool-room, or where fitting is being done and measurements are taken often, as the reading is very plain and measurements can be taken quickly.

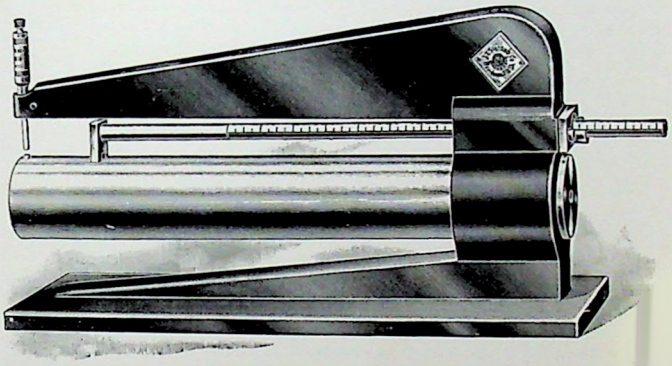
## Micrometer Heads




In making jigs, fixtures and the various special devices used in economical manufacturing, these micrometer heads can often be used to very good advantage. Often special gauges may be used to great advantage on the work in hand, but as this work is of such a special character, it would not pay anyone to regularly manufacture such special gauges or devices. With these micrometer heads you can easily make such gauges yourselves to suit your requirements. Head No. 32 has a range of 1 inch and the No. 32A has a range of ½ inch. The holding fit *A* is 7/16 inch in diameter and ¾ inch long in the No. 32A. They are intended to be held in the device by either split clamp or sweating in with soft solder. The fine adjustments are within these heads making it unnecessary to provide for such adjustments in other parts of the device. These heads are furnished in either English or Metric measure, graduated to thousandths or ten-thousandths of an inch, or to 1-100 of a millimeter. They are also furnished with friction stops when desired.

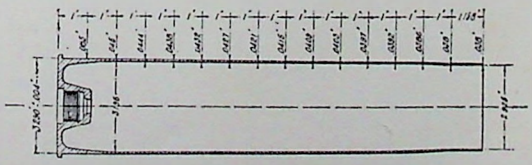
The cut on following page illustrates a device made to measure the thickness of brass cases for 3 inch shrapnel shells. This case is illustrated in section showing the measurements taken and their distances on the shell. The shell is passed over the round bar against the gauge for distance on. This length gauge is graduated in quarters, halves and inches from the end in one scale and in a second scale in inches started from the end of 1.158. The

case fits fairly closely over the bar so it is always held practically in line and by the use of the sliding gauge it is easy to accurately measure the thickness at any desired distance on



**Device for Measuring Walls of Brass Cases for Shrapnel Shells**

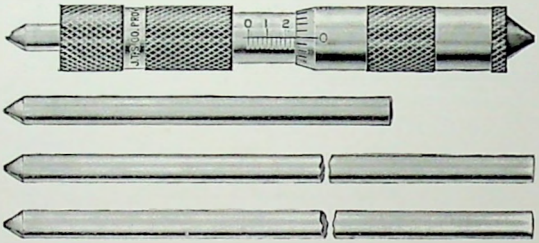
A micrometer head can be used to make a very useful stop for lathe carriage where fine side adjustments are desired. We fit a clamp to the ways of lathe, carrying the micrometer head, then put a small hardened steel plug in end of carriage to serve as an anvil for micrometer screw. Such a micrometer stop on the lathe has a wide range of uses. It can be used to graduate with, can be used to accurately gauge depths of shoulders in a bore where it is difficult to see, and to measure cuts and allowances of all kinds.



**Case for 3-Inch Shrapnel**

## Inside Micrometer Caliper No. 11

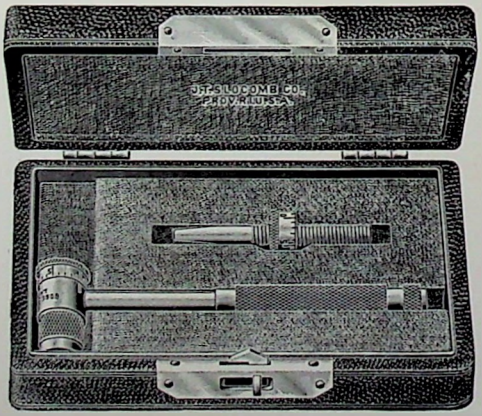
This Caliper is intended to measure inside diameters above 2½ inches. It does not measure a definite distance in inches. The micrometer screw has a range of ¼ inch, which enables allowances or differences of this amount, or less, to be accurately measured in thousandths; the diameter or length only being limited by the length of rod, which for long lengths



Inside Micrometer Caliper No. 11

can be readily cut from standard 5-32 steel rod, rods to measure diameters to 9 inches being furnished with the caliper.

This caliper can be used to very good advantage for standard measurements by setting to outside micrometer. The adjustment is easily made and then addition or subtraction can be easily made with the inside micrometer.



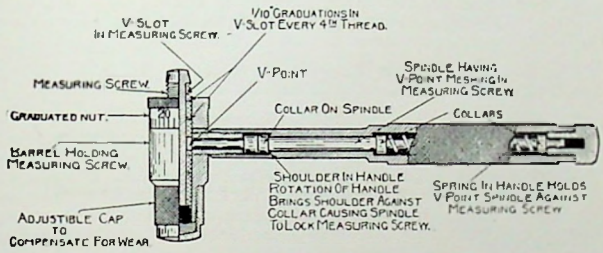

**Set No. 102**

**Standard Inside Micrometer Measuring from 1 Inch to 2 Inches**

# Small Inside Micrometer

**Measuring Holes from ½ Inch to 2 Inches and from 12 to 50 mm. Metric Measure**

**The Smallest Inside Micrometer in the World**




These Calipers are made in two sizes; one measuring from ½ to 1 inch or from 12 to 25 mm. Metric Measure, and one from 1 to 2 inches or 25 to 50 mm. Metric Measure. Each caliper is provided with two screws and each screw has its own graduated nut. The handle allows of measurements taken throughout a bore. This is important as a measurement taken at one end of bore only is often misleading.

The barrel or body of the instrument holds the measuring screw which telescopes into the same as indicated. The measuring screw is advanced from the barrel by the graduated nut. There is an adjusting cap fitting on the opposite end of the barrel and is capable of adjustment to compensate for wear. The measuring screw is prevented from rotating when being advanced by the nut by means of the spindle in the handle having a V point and being held in position by the bushing which is threaded into the side of the barrel. This V point meshes into a slot in the measuring screw, and is brought to bear on the measuring screw by means of the spring in the chamber of the handle, which handle is threaded on the bushing. After an adjustment has been made, the measuring screw is locked into position by a right hand rotation of the handle, which causes the shoulder in the same to bear on the collar, which presses the spindle against the slot in the screw.

The reading is substantially the same as the outside micrometers, the graduated nut corresponding with the thimble and 1/10 divisions cut in the groove of screws together with the tops of threads corresponding with the linear graduations of sleeve. The 1/10 graduations are cut from the bottom of the groove to the top point of the thread. *These 1/10 graduations appear at every fourth thread.* In setting these calipers it is best to do so by turning the graduated nut to the right, always drawing the screw out. In going

back it is necessary to push the screw down with the hand. Care should be taken that no dirt is caught between the nut and its shoulder.

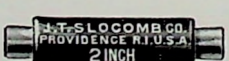
### Inserting Screw into Barrel

To make a change in the screw for different ranges of measurement, the screw already in the barrel is removed by unscrewing the handle until the tension is taken off the spring. This allows the screw to be readily removed. In inserting the screw, which is necessary for the desired measurement, care should be taken to adjust the point of the spindle so that the edge of the V is parallel to the axis of the barrel (see cut). This proper placing of the pin is accomplished by rotating the handle.

## Reference Disc.—Standard End Measure

Reference Disc

For keeping standard gauges to accurate size, reference discs and standard end measures are used, as per illustrations. For small sizes, such as for adjusting a one or two inch micrometer, the reference disc is recommended, for large sizes the end measure. These gauges are made to a high degree of accuracy. They are made of the best tool steel, hardened and afterwards heat treated, in a way to season them. A peculiar thing about hardened steel is that it will shrink to some extent, and unless treated properly will continue to shrink for a year or more. Gauges, to be accurate and lasting, must be treated to avoid this shrinkage. These standards should be used for reference only, so their accuracy may be lasting. Where much adjusting is done, as in a large shop where thousands of gauges are used, there should be two or more sets of standards, one for everyday use and one for reference only. In handling these gauges great care must be exercised to guard against changes by temperature. With a twelve-inch end measure a slight grip of the bare hand will often increase the length from two to five ten-thousandths.





End Measure

End measures are provided with rubber cover. This cover is an insulator, so that the gauges can be handled by the cover without changing temperature greatly. Considerable care should be taken of these standards to guard against rust or abrasion on their measuring surfaces. It should be understood that these gauges are liable to wear from excessive or careless use, and that they should be used by competent men only.

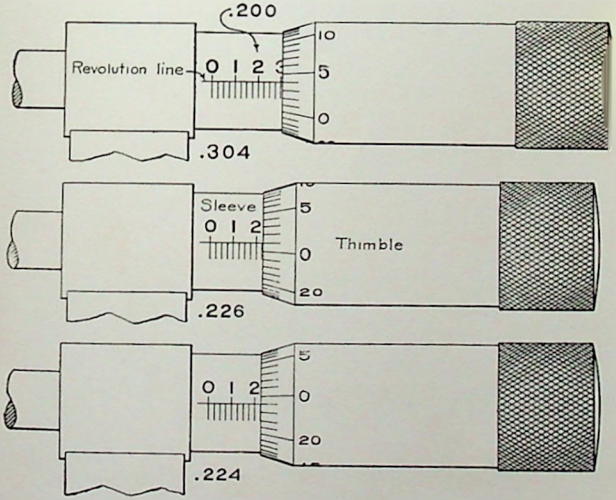
# To Read a Micrometer

A micrometer is very easily read, but of course, like many other things, rapid work is obtained only after some practice.

Many machinists read the micrometer almost at a glance.

The micrometer divides the inch in 1000 parts. As usually made it has a 40 pitch screw which advances through its nut .025 inch per revolution. It is evident that, if measurements are to be made of .025 inch or less, all the graduating can be on the end of revolving thimble only, and all that would be necessary besides this would be an indicating line on stationary part.

To measure a greater range it is necessary to have some means of counting and adding together the additional revolutions of screw. This is done




in an ingenious and very simple manner by the graduating and numbering used, and is plainly illustrated by cut, which is made about twice actual size.

The cross lines on sleeve are spaced .025 inch apart to equal the pitch of screw. A revolution line is cut lengthwise of the sleeve which in connection with the zero line on thimble counts whole revolutions of screw. When end of thimble matches any of the cross lines, and the zero line matches with the revolution line, the number of spaces exposed denote the

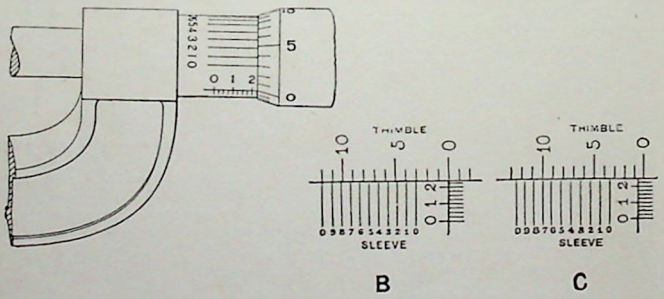
number of revolutions made. Every fourth cross line is numbered from 0 to 10.

In the first illustration the reading is .304 showing .300 on the sleeve and .004 on the thimble. In the second illustration the reading is .226 showing .225 on the sleeve and .001 on the thimble. In the third illustration the reading is .224 showing .200 on the sleeve and .024 on the thimble.

The figures should be taken off the sleeve as hundreds, that is, 100, 200, 300, etc. The thimble is shown purposely close to the lines in the cut as these are the points where a mistake would be most likely.

In the .226 reading while the end of the thimble may appear to match the cross line, it is evident that it does not for the reason that the zero lines on thimble and sleeve do not coincide but are one space advanced which, of course, we add to the .225 making the reading .226. The same is true in the .224 reading, but the zero line has gone by one space making the reading .224.

A very good way to begin in teaching a man who has never used a micrometer is to let him take a one inch size, run it down to zero or against the anvil, then have him turn the screw back, counting the graduations on thimble for four turns counting these graduations to 100. He then readily sees the use of the cross graduating and how it helps him to count.




B C

**How to Read Micrometers Graduated to Ten-Thousandths**

There are eleven parallel lines on the sleeve occupying the same space as ten lines on the thimble, these lines are numbered 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. The difference between the width of one of the ten spaces on the sleeve and one of the nine spaces on the thimble is one-tenth of a space on the thimble or one ten-thousandth of an inch in the reading of micrometer.

In Fig. B the third line from 0 on thimble coincides with the first line on the sleeve. The next two lines do not coincide by one-tenth of a space on the thimble, the next two marked 5 and 2 are two-tenths apart, and so on. When the micrometer is opened the thimble is turned to the left and each

space on the thimble represents a thousandth of an inch. Therefore when the thimble is turned so that the lines 5 and 2 coincide the micrometer is opened two-tenths of one thousandth or two ten-thousandths. If the thimble be turned further, so that the line 10 coincides with the line 7 on the sleeve, as Fig. C, the micrometer has been opened seven ten-thousandths.

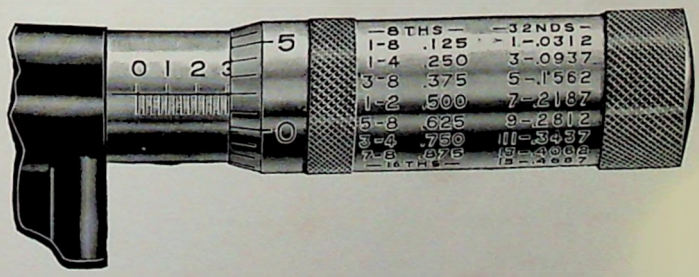
### To Read the Micrometer

Note the thousandths as usual, then observe the number of divisions on the Vernier until a line is reached which coincides with a line on the thimble. If it is the second line marked 1, add one ten-thousandth; if the third marked 2, add two ten-thousandths, etc.

While the thousandths part of an inch is the most convenient unit, and is fine enough for the general run of machine work, still there are times when this must be further divided. With an ordinary micrometer one-half and one-quarter thousandths are easily estimated. Where finer measurements than these are required, we have micrometers graduated with a vernier arranged so they will read direct on the thimble in ten-thousandths.

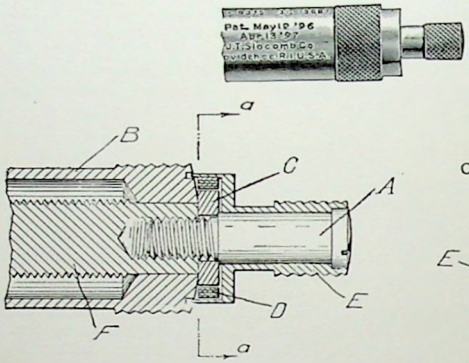
Finer measurements even than these are made with measuring machines, see pages 34-91-101 to 104, but of course every degree of refinement adds greatly to the cost.

It is not advisable to use micrometers graduated to ten-thousandths where fine measurements are not required, as wear, although it be of comparatively slight consequence in a micrometer that reads only to thousandths, is perceptible and important when making these fine measurements.




### Table of Decimal Equivalents Rolled on Micrometer Thimble

This table consists of decimal equivalents of 8ths, 16ths and 32ds rolled almost completely around thimble.

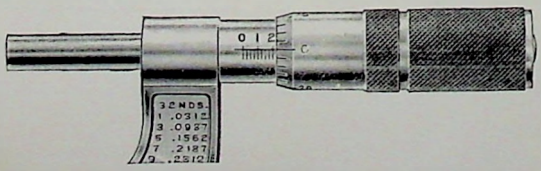



**New Friction Stop**

This device consists chiefly of a coiled flat spring *D* of nickel silver. The inner end of this spring is attached to washer *C*, which is clamped to end of thimble by shoulder on central screw *A*. The outer end slides around inside of large bore in outer revolving part; so arranged that in turning to the right the device slides over the spring, but in turning to the left the friction uncoils the spring, causing it to drive positively in this direction. This device has no parts that are liable to get out of order, and allows of a large and substantial screw for attaching; also allows of reducing the knurled part to small diameter, so as to provide a speeder as well.

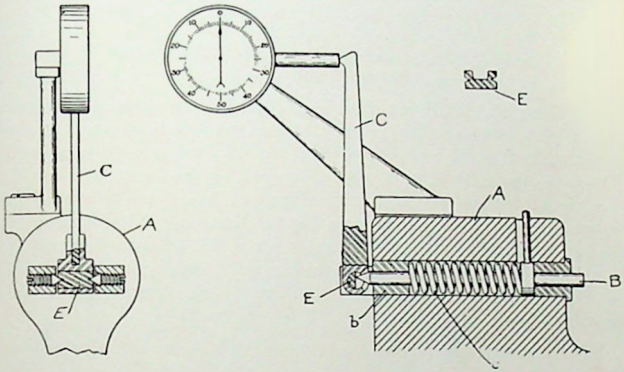
The nickel silver spring does not require lubrication, and as there is so much of it, it will not wear so as to lose its tension.

Another advantage is in the absence of click, which makes such a device rough in its action, and does not stop so positively as this friction device.




**New Friction Thimble**

The construction is practically the same as the friction stop on end of thimble.




## Anvil Arrangement Used on Slocomb Measuring Machine

The illustration above represents an arrangement we use on our measuring machines for knowing absolutely the amount of pressure applied to work when measuring. It is well known that when measuring to an accuracy of .0001 inch or less with ordinary micrometer, it is difficult to know just how much pressure is applied on the work. In the illustration *A* represents a section through part of the tail stock of measuring machine, *B* is a plunger anvil. This is a nice sliding fit through bushing *a* and *b*. This plunger anvil is kept against bushing *a* by spring *c*. The back end of this plunger is formed to a 60° angle chisel point. This chisel point rests against lever *C*. The proportion of this lever is such that a movement of plunger *B* of .0001 will move top of lever about .006. This lever is enabled to magnify to this extent by the peculiar fulcrum pin, shown at *E*. This pin is of hardened steel, halved out in the center, as shown, and is provided with centers in ends. This pin is forced in hole in lower part of lever. The pointed end of plunger *B* rests against flat pin *E* just above the center. Lever is pivoted by pointed screws entering centers in pin *E* as shown. By this arrangement we are enabled to use a lever with the long arm 4 inches, and a short arm about .062 inch. The top of this lever bears against the terminal of a dial indicator and this indicator, in combination with the magnifying lever described, indicates a movement of about $\frac{3}{8}$ inch when the plunger anvil *B* is moved .0001 inch. An interesting test with this instrument shows that the heat from three fingers of the hand applied to a 4 inch end measure $\frac{5}{16}$ inch diameter for a few seconds is sufficient to move the hand of this dial indicator $\frac{1}{4}$ inch.

## Regarding Reliable Measurements

A thoroughly reliable Standard Measuring Machine should not depend for its setting on steel plugs or end measures that are liable to wear. For reference in measuring large sizes J. T. Slocomb Co. uses a 36 inch Pratt & Whitney Measuring Machine. In this machine the locating of head for even inches is done by setting to lines on a graduated bar by the help of a powerful microscope. The lines on this bar are about 1/10000 inch wide, and are too fine to be seen by the naked eye. By this arrangement there can be no wear on the standard, consequently the greatest reliability. The following is taken from a catalog issued by the Pratt & Whitney Co., Hartford, Conn., by their consent:

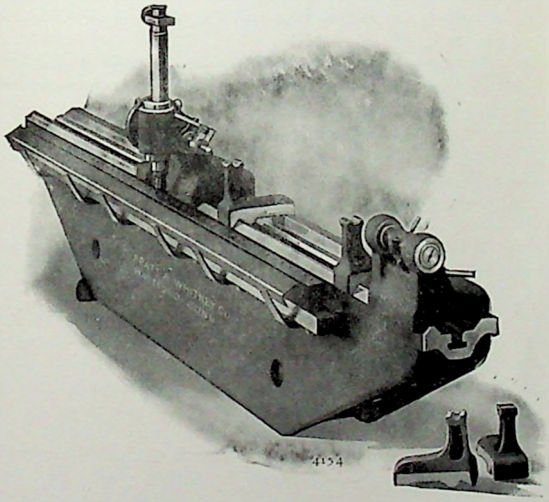
"The illustration on following page shows the latest model of the Pratt & Whitney Standard Measuring Machine. In redesigning this machine, every point brought out by experience with previous models has been carefully considered, and if practical to do so has been incorporated in this model, making it the most complete machine of its kind on the market.

"An important improvement in the machine is the raising of the standard bar at the rear of the machine to a position nearly level with the surface of the bed. This reduces to the lowest degree any error that may arise from reading with the microscope. The bed is nearly twice the weight of previous models and is of massive construction, resting on three neutral points, and cannot easily be affected by temperature or flexure. The sliding head which includes the screw and index is carefully fitted, insuring parallelism of the measuring faces at any position along the bed up to the capacity of the machine.

"The screw is standard 25 threads per inch, or one millimeter pitch for Metric System, and has adjustment for wear in both nut and shoulders. Particular attention is called to the calipering attachment, which is simple in the extreme, and solves completely the problem of end measurements within the limits of accuracy attainable in line reading by means of the microscope and micrometer eyepiece. The standard bar to which the end measurements are referred is not touched during the operation, and each measurement is derived from the same zero, so that error from end wear does not enter into the problem.

"A strong feature in the operation of this machine is the comparing of all measurements with a carefully divided and investigated standard bar, the divisions of which are marked upon hardened and polished steel

plugs set into a soft steel bar. This bar is never handled, is covered when not in use, and can in no way be injured when calipering except by accident. Delicacy of contact between the measuring faces is obtained by the use of auxiliary jaws holding a small cylindrical drop plug by the pressure of a light helical spring, which also operates the sliding spindle, to which one of the auxiliary jaws is attached. The instant the calipering surfaces are brought into perfect contact, either directly or through the



**The Pratt & Whitney Measuring Machine**

work, the tension on the spring is so adjusted that the plug which is held in a horizontal position by friction will swing toward a vertical position, any excess pressure causing the plug to drop out. An adjusting device for the index line provides for any slight variation of the position of the calipering faces at zero.

"The British Imperial Yard, which is carefully preserved at the Royal Observatory at Greenwich, consists of a bronze bar 38 inches long, with two gold plugs inserted at a distance of 36 inches apart. Upon the polished

surfaces of each is a very fine line, the distance between which, at a temperature of 62° Fahrenheit, represents the standard yard from which all English measurements are derived.

"The Standard Meter established by law consists of a bar of platinum and iridium, 90 parts of the former to 10 parts of the latter. This is an end measure and derives its length from the report of a commission appointed by the French Government, and which recommended a measure derived from a quadrant of the earth's meridian divided into ten million equal parts, the meter being a subdivision and is equal to 39.370788 inches English measure.

"This bar is standard only at 0° Centrigrade, and is kept in the International Bureau at Breteuil, between Paris and Versailles, where we have recently had plugs verified.

"Upon these two standards Pratt & Whitney Measuring Machines are based. The English graduated Machines are standard only at 62° Fahr., and the Metric Machines at 0° Centrigrade.

"It is understood, however, that it is not necessary to use the machines at the initial temperature, as once standardized any variation of temperature will affect both the work and the machine alike, and give readings that will be correct for light materials, not only at the initial temperature, but at any temperature at which the readings may be taken.

"Machines for English measurements have 400 graduations on the index circle, reading to 1/10000 inch, and for metric measurements have 500 graduations, reading 1/500 millimeter (1/12500 inch nearly). These divisions can easily be subdivided into quarters or even less by estimation."

# Johansson Gauges
## Used by J. T. Slocomb Co.

The Johansson Gauges are, without doubt, the most accurate standards known. In order to keep micrometer calipers to the very closest limits of accuracy, the most accurate and reliable gauges are a necessity. In making gauges to an accuracy of one ten-thousandth, it is evident that the master gauges must be very much closer than this. It is claimed that these Johansson Gauges can be made to an accuracy of one millionth inch. However this may be, it is a fact that these gauges are more accurate than heretofore produced. One set of these gauges consists of 81 blocks so proportioned that any measurement can be obtained by ten thousandths of an inch by piling them together. The surfaces are so accurate that when they are perfectly clean, these blocks will wring together excluding the air so as to hold together with remarkable firmness. With this set of gauges we are able to test our micrometers at any point of their graduations; also we are able to correct our master screw to the highest degree of accuracy. By locking together three of these blocks so that the outside ones overlap, forming an external gauge held together by air pressure only, it is possible to insert another standard of exactly the same dimension, pushing it through while removing the first center plug, making the second one take its place without breaking the joint. This seems to disprove the common idea that a plug must be smaller than a hole in order to enter. It is possible that the air pressure allows these blocks to separate to some extent, but it must be an almost inconceivable amount.

## Making Proper Allowances for Various Classes of Fits

The question often occurs how much allowance to make for a certain kind of a fit. If the fit must be a tight one, forced or shrunk together, the shaft must be larger than the bore. If the hub is of soft and tough metal, such as soft steel or bronze, and is thin, it is evident that some allowance must be made for the stretching of metal in hub. If the surfaces are rough, rough turning and rough boring, some allowance must be made for the flattening down of these rough surfaces. Then again, the bore and shaft are often out of round and not axially true. A shaft that is out of round is often larger than it measures, also a bore that is not axially straight appears smaller than it is, in a running fit. Cored holes bored by various kinds of reamers only, are liable to be crooked on account of tools springing, and so following, to some extent, direction of core. For this reason, as a rule, a long bearing, in a running fit, requires more allowance than a short one. Where surfaces are hard and perfectly true and smooth, as in Standard Plug and Ring Gauges, very small allowances suffice.

The following table of allowances will be found useful for good average machine work:

| FORCE FITS (for Shafts) | DRIVING FITS (for Shafts) |
|---|---|
| Up to ½ in. + .0005 to .001 | + .0004 to .0006 |
| ½ in. to 1 in. + .001 to .003 | + .0004 to .001 |
| 1 in. to 2 in. + .002 to .004 | + .00075 to .002 |
| 2 in. to 3 in. + .003 to .006 | + .0015 to .003 |
| 3 in. to 4 in. + .005 to .008 | + .002 to .004 |
| 4 in. to 5 in. + .006 to .010 | + .002 to .0045 |
| 5 in. to 6 in. + .008 to .012 | + .003 to .005 |
| **PUSH FITS** | **RUNNING FITS** |
| Up to ½ in. — .00025 to .00075 | — .00075 to .0015 |
| ½ in. to 1 in. — .0005 to .001 | — .001 to .002 |
| 1 in. to 2 in. — .0005 to .0015 | — .0015 to .0025 |
| 2 in. to 3 in. — .0005 to .0015 | — .0015 to .003 |
| 3 in. to 4 in. — .00075 to .002 | — .002 to .0035 |
| 4 in. to 5 in. — .00075 to .002 | — .0025 to .004 |
| 5 in. to 6 in. — .00075 to .002 | — .0025 to .0045 |

# The Modern Shop

We view the modern machine shop with a great deal of satisfaction for it bears out the contention we have always made—that in time the haphazard way of working and measuring would be discarded for something accurate and comprehensive.

The writer's experience in an old shop in Maine over thirty years ago strongly impressed upon his mind the necessity of improvement in the means of measuring in machine shops. The loss occasioned by some of their ways of measuring would hardly be believed in an up-to-date shop today.

One instance of this was in the finishing of line shafting. These bars were turned from black stock, usually to the largest diameter that would finish out. While a 2 inch shaft was normally $1\frac{15}{16}$, different orders were liable to vary as much as .025. Such work was scattered all over the country in various sawmills and other factories, and when it became necessary to add more pulleys or make changes, the mill had no means of measuring this shaft, so sent an approximate measurement of the shafting. I have seen a factory hung up for a week after an order had been received because of the fact that the parts did not fit, all of which could have been avoided by the use of micrometer calipers.

Even in these days we find the question of proper measuring is not appreciated to the extent that it should be. To make the micrometer the greatest success in a shop, it is necessary that the workman be educated to its use. This is not a difficult matter, and there is no occasion for mistakes in the reading. Such things are due to the fact that the workman has not had a proper education and practice with these tools. Micrometer calipers will take the place of thousands of solid gauges; besides they will do a great deal better work and in a much more comprehensive manner.

Another fact that is not generally known is that micrometer calipers are far more accurate than the average snap gauge found in machine shops.

We feel very sure that the suggestion of comparing the use of the micrometer caliper with the steel rule, as brought out at the beginning of this book, would lead to the best results in most shops if properly appreciated.

Reprinted from *Machinery*, December, 1914

# The Micrometer Caliper as a Machine Shop Gauge

## Some Reminiscences and Ideas

BY J. T. SLOCOMB

My first experience in a machine shop was in 1881 at Bangor, Maine. It was in a shop devoted to general saw mill work and to all sorts of jobbing. We had a great variety of fits to make, often having to bore a hub for a driving fit on a shaft that was miles away from the shop. We were not provided with hydraulic presses, screw presses or much of anything else in the line of convenience. The only way of forcing fits was with sledge hammer, driving on a wooden block. If a hub was forced part way on and stopped, it was likely to make a lot of trouble. These things led me to a strong belief that something better than the calipers we were using would be a godsend to shops of our kind. In 1885 I went to work for the Brainard Milling Machine Co. in Hyde Park, Mass., and it was there I saw the first micrometer caliper. In a conversation one day with Mr. M——— he asked if I had ever seen a micrometer, and then produced one from his kit where he had it carefully nested in some clean cotton waste. He told me it was a good tool to find odd sizes of wire with. This started me to thinking and, as my experience had not included wire work, I naturally began to associate this new magnifying gauge with general machine shop work.

About a year later, I went to work for the Brown & Sharpe Mfg. Co. at Providence, R. I. Although the B. & S. Co. had been making these calipers in small sizes for fifteen years or more, it seemed that for general machine work they had not fully appreciated their value. One of the foremen had a two-inch micrometer that he had made himself, and said he graduated it with a monkey wrench. This caliper was the most borrowed tool I ever saw, which, of course, went to show the demand for such a tool in that shop. Several years later through one of the queer turns of fate, I found myself associated with a small manufacturing business. In the summer of 1892 or 1893 we were struggling along under a panicky business condition, a time which will be remembered by a great many. The lack of regular work at that time gave me plenty of opportunity to make plans, and then the old idea of an improved machine shop gauge began to take form which resulted in the Slocomb micrometer. It seemed that there was a field for these instruments in the larger sizes. The first micrometers undertaken were the sizes between 3 inches and 8 inches. We found, however, that the market was not ready for large sizes and for this reason were forced to make the smaller ones as well.

One of our first orders came from a Cleveland dealer for four of the 1-inch size. These tools were returned about as promptly as the mail could bring

them, with a long friendly letter of advice. The advice was for us to quit the manufacture of such an instrument of precision with the "horseshoe" part finished in black enamel "where it was necessary to be nicely polished." This advice was mainly valuable in showing how micrometers were regarded and what we had to contend with. First came the fellow who stated that the micrometer was too expensive, then the other fellow who stated that it led to mistakes and was not to be trusted, and lastly the party who thought it was jewelry. In designing a micrometer especially for the machine shop, the matter of durability as well as accuracy came in for a large share of attention. Then again, as these tools were intended for everyday service, a matter of finish that was not essential and added to the cost was omitted. These experiences were all gained over twenty years ago, and I view with considerable satisfaction the developments in this time. I have a whole lot of faith in a thing that is *right* winning out if it is persisted in. The importance of making work to interchangeable sizes and the wonderful growth of automobile manufacture has been responsible in a large way for the extended use of micrometers.

There was an idea common twenty years ago that if a lot of snap gauges running by even sixteenths of an inch were provided, in some mysterious way all of the variations would adjust themselves naturally. What really happened was that the variations, which were the rule, were taken care of by the fit-together method, and the resulting work was not interchangeable. Looking at this subject squarely, there are a great variety of fits required, calling for a great many measurements. A running fit in a long bearing or hub usually has to have more allowance than where the bearing or hub is short, and the same applies to tight or force fits. Soft or hard materials, thick or thin walls of hubs, rough or smooth surfaces (whether ground or lapped or rough-turned) and the general grade of work all have a bearing on the measurements. In my opinion to meet all of these conditions, the micrometer is the most satisfactory tool known when it is used as it should be. Where approximate measurements are necessary we use a steel scale and read it directly off the work. This not only shows that the work is the desired size, but it shows *how much* larger or smaller it is, which is useful information. In making a nice fit, the micrometer will do the same thing as the steel scale but with the necessary refinement. Do not lock the micrometer to some size and then use it like a snap gauge. If you do, you lose three-quarters of its value.

I have not furnished a locking device for the reason that I believe it detrimental to the best use of the micrometer and that it would tend to hinder the general adoption of micrometers in the machine shop. I make a distinction between gauging and measuring. If you are inspecting—only finding out if some size is or is not correct—this gauging might answer, but in the making, where if a size is not correct (which is likely) you want to know how much stock remains, then you want to measure and not gauge.

A single micrometer with one-inch range will cover the range of about four thousand snap gauges besides being valuable in many other ways. Some practice with micrometers is, of course, needed to get the best results, but this is easily attained and when attained there is no more liability of making mistakes in the reading than there is in the use of the ordinary steel scale. A great help to the use of micrometer calipers is to have graduated dials on all machines adjusting screws for lathes, planers,

milling machines, grinders and where fine adjustments are made. These dials should be graduated to read in thousandths inch so that cuts can be adjusted to conform with measurements as found by the micrometer. To be sure, all of these screws are not accurate to pitch, but for the small adjustments necessary the error is not enough to be troublesome. Milling machines and grinding machines have been provided with such dials almost from the first, but they are just as necessary on lathes and planers.

In making interchangeable work, one way that has been in favor for a good many years is to make a sample or model machine, then disassemble the parts and use these as models for duplicating parts. This was the only reasonable way until the advent of micrometer calipers. Today it is perfectly feasible to put all necessary dimensions on a set of drawings so that a machine can be duplicated at any time and make good fits. Besides, this plan will produce better results, because measurements are stated on drawings, but in the case of the model, measurements of the model have to be made repeatedly with the consequent chances for making errors.

As I stated before, it was difficult to sell micrometers above the two-inch size, but now there is a demand for the large sizes running as high as 36 inches, and even larger. One reason for the demand for these large calipers is that a large shaft costs a good deal of money, and it is important that the greatest care be taken in making the fits, as it costs a great deal more to spoil a large piece than a small one. In the handling of these large micrometers, it has been found a help to use a pulley, cord and weight over the machine to act as a counterweight. This arrangement effects a convenience in having the micrometer always at hand, for the weight can be adjusted slightly in excess so that the caliper stays suspended over the machine but within reach.

On first thought it might appear that micrometers should be made with more than one-inch range each. There are several objections to this plan and there is not much in favor of it. As micrometers are usually made the spindle or screw when way down overhangs about $1\frac{1}{16}$ inch. A greater overhang than this causes some spring when "feeling" the caliper over the work. This, of course, could be provided for by making the parts larger, but this would necessitate making them heavier which would be an objection. The shorter screw is more easily made accurate and the accuracy is more easily maintained than in a long one. In shops where a good many men are employed, a large number of calipers must be furnished, and they may as well be of different sizes. Some of the devices I have seen for making a micrometer with a two-inch range cost as much to make as two separate micrometers. Sliding anvils and attachments are a source of inaccuracy through maladjustments. In a place where extreme reliability is desired, as in micrometer calipers, it is best to have them simple, without attachments and with the least possible chance for mistakes.

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# How We Came to Have the Slocomb Shop Micrometer

By J. T. SLOCOMB

The principle of the micrometer is very old. The particular reading as commonly used on the sleeve and thimble, as far as I know, came from the Palmer patent.

The first micrometer I ever saw was one made by A. J. Wilkinson at Hyde Park, Mass. This was in 1884. It was a one-inch caliper and had a covered screw. Mr. Wilkinson was making them in a factory devoted to dental instruments. The machinist who showed me this caliper said, "It is a useful tool to gauge wire with," and I believe that he expressed the general opinion of micrometers at that time. They were not machine shop measuring instruments.

During my stay in the Brown & Sharpe works—from 1885 to 1890—I thought I saw the possibility of micrometer calipers, although I did not at the time contemplate going into business. In 1893 I was in business and was looking about for something to manufacture. It occurred to me that the micrometer was something that could be developed into a valuable machine shop tool. I had had a good deal of experience in machine shops and thought I knew how to design a micrometer to cover machine shop requirements. It was practically the same problem as taking a lathe that was used for experimental purposes and improving upon it or redesigning it for heavy-duty machine shop service.

Perhaps there have been few tools gotten out that have been so much misunderstood as the Slocomb micrometer. Because we left off some of the metal polish on the frame, people thought this part cast iron and formed the impression that the rest of the tool was in keeping with it. A well-known maker of machine tools a good many years ago made screw machines with the bed planed and polished all over. The rest of the machine was of a type common to that period with short and small bearings, weak drive, and was what would be called today generally inefficient.

Now as a comparison with Slocomb micrometers, suppose at that time some one had designed a screw machine with all the modern features but left off the polish on the bed; would this new machine have been considered cheap or inferior? This was exactly the case with the Slocomb micrometer. I designed a form of bearing nuts that increased surface of thread contact about four times over what was common without increasing the size or weight materially. I put in an all tool steel screw considerably larger in diameter than the regular one without increasing the outside diameter of the tool materially. I put in a solid anvil and an improved form of adjustment that made these parts more substantial and more easily adjusted. I put a spring between the nuts arranged in such a way that there is a slight uniform friction throughout the range of the screw regardless of the wear

of parts. This spring tension allows the micrometer to be screwed down upon the work, taken off and the measurement read without danger of the screw's turning of its own accord. I designed a new style of I-beam frame, providing for the greatest stiffness without increasing the weight. Altogether, I designed what others call now the heavy-type micrometer, but what I call the high-duty Slocomb micrometer, and put this into such shape that it is accurate, easy to handle, very durable and moderate in price. It is evident that this I-beam frame could not well be finished in bright metal. I could have sand-blasted and nickel-plated them, but nickel-plate was in disrepute in machine shops. The black enamel is a non-conductor of heat and for other reasons seemed the most appropriate finish.

In 1894 I made a precision screw and designed and constructed a special lathe so made that the accuracy of this screw is surely duplicated in the work. The trouble in doing this with regular lathes is that the lead-screw is too far off one side of the cutting tool so that any irregularities in the smoothness of carriage are manifested in inaccurate work. With this new lathe and new large precision screw, I was able to cut accurate threads on tool steel, something that no one else has been able to do commercially so far as I know. This accurate tool steel screw was the greatest boost the micrometer ever had for machine shop requirements.

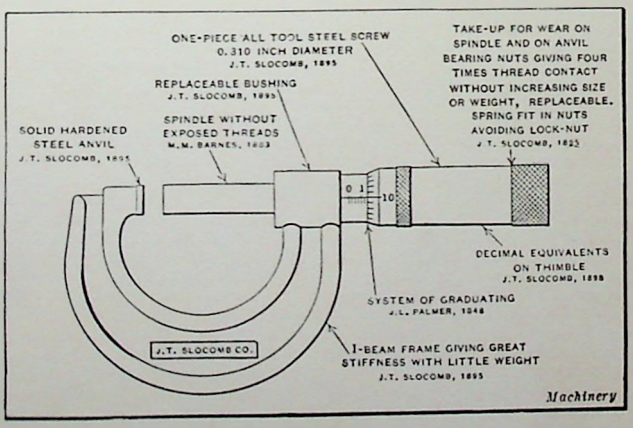



**Diagram Illustrating the Features of the Slocomb High Duty Micrometer and Their Inventors**

## Table of Decimal Equivalents

| Inch | | Inch | |
|---|---|---|---|
| | 1/64 .0156 | | 33/64 .5156 |
| 1/32 | .0313 | 17/32 | .5313 |
| | 3/64 .0469 | | 35/64 .5469 |
| 1/16 | .0625 | 9/16 | .5625 |
| | 5/64 .0781 | | 37/64 .5781 |
| 3/32 | .0938 | 19/32 | .5938 |
| | 7/64 .1094 | | 39/64 .6094 |
| 1/8 | .125 | 5/8 | .625 |
| | 9/64 .1406 | | 41/64 .6406 |
| 5/32 | .1563 | 21/32 | .6563 |
| | 11/64 .1719 | | 43/64 .6719 |
| 3/16 | .1875 | 11/16 | .6875 |
| | 13/64 .2031 | | 45/64 .7031 |
| 7/32 | .2188 | 23/32 | .7188 |
| | 15/64 .2344 | | 47/64 .7344 |
| 1/4 | .250 | 3/4 | .750 |
| | 17/64 .2656 | | 49/64 .7656 |
| 9/32 | .2813 | 25/32 | .7813 |
| | 19/64 .2969 | | 51/64 .7969 |
| 5/16 | .3125 | 13/16 | .8125 |
| | 21/64 .3281 | | 53/64 .8281 |
| 11/32 | .3438 | 27/32 | .8438 |
| | 23/64 .3594 | | 55/64 .8594 |
| 3/8 | .375 | 7/8 | .875 |
| | 25/64 .3906 | | 57/64 .8906 |
| 13/32 | .4063 | 29/32 | .9063 |
| | 27/64 .4219 | | 59/64 .9219 |
| 7/16 | .4375 | 15/16 | .9375 |
| | 29/64 .4531 | | 61/64 .9531 |
| 15/32 | .4688 | 31/32 | .9688 |
| | 31/64 .4844 | | 63/64 .9844 |
| 1/2 | .500 | 1 | 1.000 |

## Table of Millimeter Equivalents of Parts of an Inch

| Inch | mm. | Inch | mm. |
|---|---|---|---|
| 1/64 | .397 | 33/64 | 13.097 |
| 1/32 | .794 | 17/32 | 13.494 |
| 3/64 | 1.191 | 35/64 | 13.890 |
| 1/16 | 1.587 | 9/16 | 14.287 |
| 5/64 | 1.984 | 37/64 | 14.684 |
| 3/32 | 2.381 | 19/32 | 15.081 |
| 7/64 | 2.778 | 39/64 | 15.478 |
| 1/8 | 3.175 | 5/8 | 15.875 |
| 9/64 | 3.572 | 41/64 | 16.272 |
| 5/32 | 3.969 | 21/32 | 16.669 |
| 11/64 | 4.366 | 43/64 | 17.065 |
| 3/16 | 4.762 | 11/16 | 17.462 |
| 13/64 | 5.159 | 45/64 | 17.859 |
| 7/32 | 5.556 | 23/32 | 18.256 |
| 15/64 | 5.953 | 47/64 | 18.653 |
| 1/4 | 6.350 | 3/4 | 19.050 |
| 17/64 | 6.747 | 49/64 | 19.447 |
| 9/32 | 7.144 | 25/32 | 19.844 |
| 19/64 | 7.541 | 51/64 | 20.240 |
| 5/16 | 7.937 | 13/16 | 20.637 |
| 21/64 | 8.334 | 53/64 | 21.034 |
| 11/32 | 8.731 | 27/32 | 21.431 |
| 23/64 | 9.128 | 55/64 | 21.828 |
| 3/8 | 9.525 | 7/8 | 22.225 |
| 25/64 | 9.922 | 57/64 | 22.622 |
| 13/32 | 10.319 | 29/32 | 23.019 |
| 27/64 | 10.716 | 59/64 | 23.415 |
| 7/16 | 11.113 | 15/16 | 23.812 |
| 29/64 | 11.509 | 61/64 | 24.209 |
| 15/32 | 11.906 | 31/32 | 24.606 |
| 31/64 | 12.303 | 63/64 | 25.003 |
| 1/2 | 12.700 | 1 | 25.400 |

## Table of Decimal Equivalents of Millimeters and Fractions of Millimeters

$\frac{1}{100}$ mm. = .0003937 Inch

| mm. | Inch | mm. | Inch | mm. | Inch |
|---|---|---|---|---|---|
| $\frac{1}{100}$ | .00079 | $\frac{21}{100}$ | .02047 | 2 | .07847 |
| $\frac{2}{100}$ | .00157 | $\frac{22}{100}$ | .02126 | 3 | .11811 |
| $\frac{3}{100}$ | .00236 | $\frac{23}{100}$ | .02205 | 4 | .15748 |
| $\frac{4}{100}$ | .00315 | $\frac{24}{100}$ | .02283 | 5 | .19685 |
| $\frac{5}{100}$ | .00394 | $\frac{25}{100}$ | .02362 | 6 | .23622 |
| $\frac{6}{100}$ | .00472 | $\frac{26}{100}$ | .02441 | 7 | .27559 |
| $\frac{7}{100}$ | .00551 | $\frac{27}{100}$ | .02520 | 8 | .31496 |
| $\frac{8}{100}$ | .00630 | $\frac{28}{100}$ | .02598 | 9 | .35433 |
| $\frac{9}{100}$ | .00709 | $\frac{29}{100}$ | .02677 | 10 | .39370 |
| $\frac{10}{100}$ | .00787 | $\frac{30}{100}$ | .02756 | 11 | .43307 |
| $\frac{11}{100}$ | .00866 | $\frac{31}{100}$ | .02835 | 12 | .47244 |
| $\frac{12}{100}$ | .00945 | $\frac{32}{100}$ | .02913 | 13 | .51181 |
| $\frac{13}{100}$ | .01024 | $\frac{33}{100}$ | .02992 | 14 | .55118 |
| $\frac{14}{100}$ | .01102 | $\frac{34}{100}$ | .03071 | 15 | .59055 |
| $\frac{15}{100}$ | .01181 | $\frac{35}{100}$ | .03150 | 16 | .62992 |
| $\frac{16}{100}$ | .01260 | $\frac{36}{100}$ | .03228 | 17 | .66929 |
| $\frac{17}{100}$ | .01339 | $\frac{37}{100}$ | .03307 | 18 | .70866 |
| $\frac{18}{100}$ | .01417 | $\frac{38}{100}$ | .03386 | 19 | .74803 |
| $\frac{19}{100}$ | .01496 | $\frac{39}{100}$ | .03465 | 20 | .78740 |
| $\frac{20}{100}$ | .01575 | $\frac{40}{100}$ | .03543 | 21 | .82677 |
| $\frac{21}{100}$ | .01654 | $\frac{41}{100}$ | .03622 | 22 | .86614 |
| $\frac{22}{100}$ | .01732 | $\frac{42}{100}$ | .03701 | 23 | .90551 |
| $\frac{23}{100}$ | .01811 | $\frac{43}{100}$ | .03780 | 24 | .94488 |
| $\frac{24}{100}$ | .01890 | $\frac{44}{100}$ | .03858 | 25 | .98425 |
| $\frac{25}{100}$ | .01969 | 1 | .03937 | 26 | 1.02362 |

10 mm. = 1 centimeter = 0.3937 inch.
10 cm. = 1 decimeter = 3.937 inch.
10 dm. = 1 meter = 39.37 inch.
25.4 mm. = 1 English inch.

# English Inches into Millimeters

| Inch. | 0 | 1/16 | 1/8 | 3/16 | 1/4 | 5/16 | 3/8 | 7/16 | 1/2 | 9/16 | 5/8 | 11/16 | 3/4 | 13/16 | 7/8 | 15/16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0 | 1.6 | 3.2 | 4.8 | 6.4 | 7.9 | 9.5 | 11.1 | 12.7 | 14.3 | 15.9 | 17.5 | 19.1 | 20.6 | 22.2 | 23.8 |
| 1 | 25.4 | 27.0 | 28.6 | 30.2 | 31.7 | 33.3 | 34.9 | 36.5 | 38.1 | 39.7 | 41.3 | 42.9 | 44.5 | 46.0 | 47.6 | 49.2 |
| 2 | 50.8 | 52.4 | 54.0 | 55.6 | 57.1 | 58.7 | 60.3 | 61.9 | 63.5 | 65.1 | 66.7 | 68.3 | 69.8 | 71.4 | 73.0 | 74.6 |
| 3 | 76.2 | 77.8 | 79.4 | 81.0 | 82.5 | 84.1 | 85.7 | 87.3 | 88.9 | 90.5 | 92.1 | 93.7 | 95.2 | 96.8 | 98.4 | 100.0 |
| 4 | 101.6 | 103.2 | 104.8 | 106.4 | 108.0 | 109.5 | 111.1 | 112.7 | 114.3 | 115.9 | 117.5 | 119.1 | 120.7 | 122.2 | 123.8 | 125.4 |
| 5 | 127 | 128.6 | 130.2 | 131.8 | 133.4 | 134.9 | 136.5 | 138.1 | 139.7 | 141.3 | 142.9 | 144.5 | 146.1 | 147.6 | 149.2 | 150.8 |
| 6 | 152.4 | 154.0 | 155.6 | 157.2 | 158.8 | 160.3 | 161.9 | 163.5 | 165.1 | 166.7 | 168.3 | 169.9 | 171.5 | 173.0 | 174.6 | 176.2 |
| 7 | 177.8 | 179.4 | 181.0 | 182.6 | 184.2 | 185.7 | 187.3 | 188.9 | 190.5 | 192.1 | 193.7 | 195.3 | 196.9 | 198.4 | 200.0 | 201.6 |
| 8 | 203.2 | 204.8 | 206.4 | 208.0 | 209.6 | 211.1 | 212.7 | 214.3 | 215.9 | 217.5 | 219.1 | 220.7 | 222.3 | 223.8 | 225.4 | 227.0 |
| 9 | 228.6 | 230.2 | 231.8 | 233.4 | 235.0 | 236.5 | 238.1 | 239.7 | 241.3 | 242.9 | 244.5 | 246.1 | 247.7 | 249.2 | 250.8 | 252.4 |
| 10 | 254.0 | 255.6 | 257.2 | 258.8 | 260.4 | 261.9 | 263.5 | 265.1 | 266.7 | 268.3 | 269.9 | 271.5 | 273.1 | 274.6 | 276.2 | 277.8 |
| 11 | 279.4 | 281.0 | 282.6 | 284.2 | 285.7 | 287.3 | 288.9 | 290.5 | 292.1 | 293.7 | 295.3 | 296.9 | 298.4 | 300.0 | 301.6 | 303.2 |
| 12 | 304.8 | 306.4 | 308.0 | 309.6 | 311.1 | 312.7 | 314.3 | 315.9 | 317.5 | 319.1 | 320.7 | 322.3 | 323.8 | 325.4 | 327.0 | 328.6 |
| 13 | 330.2 | 331.8 | 333.4 | 335.0 | 336.5 | 338.1 | 339.7 | 341.3 | 342.9 | 344.5 | 346.1 | 347.7 | 349.2 | 350.8 | 352.4 | 354.0 |
| 14 | 355.6 | 357.2 | 358.8 | 360.4 | 361.9 | 363.5 | 365.1 | 366.7 | 368.3 | 369.9 | 371.5 | 373.1 | 374.6 | 376.2 | 377.8 | 379.4 |
| 15 | 381.0 | 382.6 | 384.2 | 385.8 | 387.3 | 388.9 | 390.5 | 392.1 | 393.7 | 395.3 | 396.9 | 398.5 | 400.0 | 401.6 | 403.2 | 404.8 |
| 16 | 406.4 | 408.0 | 409.6 | 411.2 | 412.7 | 414.3 | 415.9 | 417.5 | 419.1 | 420.7 | 422.3 | 423.9 | 425.4 | 427.0 | 428.6 | 430.2 |
| 17 | 431.8 | 433.4 | 435.0 | 436.6 | 438.1 | 439.7 | 441.3 | 442.9 | 444.5 | 446.1 | 447.7 | 449.3 | 450.8 | 452.4 | 454.0 | 455.6 |
| 18 | 457.2 | 458.8 | 460.4 | 462.0 | 463.5 | 465.1 | 466.7 | 468.3 | 469.9 | 471.5 | 473.1 | 474.7 | 476.2 | 477.8 | 479.4 | 481.0 |
| 19 | 482.6 | 484.2 | 485.8 | 487.4 | 488.9 | 490.5 | 492.1 | 493.7 | 495.3 | 496.9 | 498.5 | 500.1 | 501.6 | 503.2 | 504.8 | 506.4 |
| 20 | 508.0 | 509.6 | 511.2 | 512.8 | 514.3 | 515.9 | 517.5 | 519.1 | 520.7 | 522.3 | 523.9 | 525.5 | 527.0 | 528.6 | 530.2 | 531.8 |
| 21 | 533.4 | 535.0 | 536.6 | 538.2 | 539.7 | 541.3 | 542.9 | 544.5 | 546.1 | 547.7 | 549.3 | 550.9 | 552.4 | 554.0 | 555.6 | 557.2 |
| 22 | 558.8 | 560.4 | 562.0 | 563.6 | 565.1 | 566.7 | 568.3 | 569.9 | 571.5 | 573.1 | 574.7 | 576.3 | 577.8 | 579.4 | 581.0 | 582.6 |
| 23 | 584.2 | 585.8 | 587.4 | 589.0 | 590.5 | 592.1 | 593.7 | 595.3 | 596.9 | 598.5 | 600.1 | 601.7 | 603.2 | 604.8 | 606.4 | 608.0 |

39.37 in. = 1 m. = 10 dm. = 100 cm. = 1000 mm. 24.00 in. = 0.6096 m. 1 yd. = 0.9144 m. 1 mile = 1609.3 m.

## Tap Drill Sizes

### For Machine Screw Taps

| Size of Tap | Outside Diam. of Tap | Decimal Size of Drills | Number Sizes |
|---|---|---|---|
| 2 x 56 | .0872 | .073 | 49 |
| 2 x 64 | .0871 | .076 | 48 |
| 3 x 48 | .1003 | .079 | 46 |
| 3 x 56 | .1002 | .086 | 44 |
| 4 x 36 | .1135 | .089 | 43 |
| 4 x 40 | .1134 | .093 | 42 |
| 5 x 36 | .1265 | .099 | 39 |
| 5 x 40 | .1264 | .104 | 37 |
| 6 x 32 | .1396 | .106 | 36 |
| 6 x 36 | .1395 | .110 | 35 |
| 6 x 40 | .1394 | .113 | 33 |
| 7 x 30 | .1526 | .116 | 32 |
| 7 x 32 | .1526 | .120 | 31 |
| 8 x 30 | .1656 | .128 | 30 |
| 8 x 32 | .1656 | .136 | 29 |
| 9 x 24 | .1788 | .136 | 29 |
| 9 x 28 | .1787 | .140 | 28 |
| 9 x 30 | .1786 | .144 | 27 |
| 9 x 32 | .1786 | .149 | 25 |
| 10 x 24 | .1918 | .149 | 25 |
| 10 x 30 | .1916 | .157 | 22 |
| 10 x 32 | .1916 | .159 | 21 |
| 12 x 28 | .2176 | .173 | 17 |
| 14 x 20 | .2439 | .185 | 13 |
| 14 x 24 | .2438 | .196 | 9 |
| 16 x 20 | .2699 | .206 | 5 |
| 18 x 18 | .2959 | .228 | 1 |
| 18 x 20 | .2959 | .234 | A |
| 20 x 18 | .3219 | .250 | E |
| 20 x 20 | .3219 | .257 | F |
| 22 x 16 | .3480 | .272 | I |
| 22 x 18 | .3479 | .281 | K |
| 24 x 16 | .3740 | .302 | N |
| 24 x 18 | .3739 | .310 | N or O |
| 26 x 14 | .4001 | .316 | O |
| 26 x 16 | .4000 | .323 | P |
| 28 x 14 | .4261 | .339 | R |
| 28 x 16 | .4260 | .348 | S |
| 30 x 14 | .4521 | .368 | U |
| 30 x 16 | .4520 | .377 | V |

## Tap Drill Sizes
## For A. S. M. E. St'd

### Machine Screw Taps

The diameter of drill allows for a practical clearance at the root of the thread so no undue strain is imposed on tap.

| Size of Tap | No. of Threads | Size of Drill | Size of Tap | No. of Threads | Size of Drill |
|---|---|---|---|---|---|
| 0 | 80 | .0465 | 10 | 24 | .140 |
| 1 | 64 | .055 | 10 | 30 | .152 |
| 1 | 72 | .0595 | 10 | 32 | .154 |
| 2 | 56 | .0670 | 12 | 24 | .166 |
| 2 | 64 | .070 | 12 | 28 | .173 |
| 3 | 48 | .076 | 14 | 20 | .182 |
| 3 | 56 | .0785 | 14 | 24 | .1935 |
| 4 | 36 | .080 | 16 | 20 | .209 |
| 4 | 40 | .082 | 16 | 22 | .213 |
| 4 | 48 | .089 | 18 | 18 | .228 |
| 5 | 36 | .0935 | 18 | 20 | .234 |
| 5 | 40 | .098 | 20 | 18 | .257 |
| 5 | 44 | .0995 | 20 | 20 | .261 |
| 6 | 32 | .1015 | 22 | 16 | .272 |
| 6 | 36 | .1065 | 22 | 18 | .281 |
| 6 | 40 | .110 | 24 | 16 | .295 |
| 7 | 30 | .113 | 24 | 18 | .302 |
| 7 | 32 | .116 | 26 | 14 | .316 |
| 7 | 36 | .120 | 26 | 16 | .323 |
| 8 | 30 | .1285 | 28 | 14 | .339 |
| 8 | 32 | .1285 | 28 | 16 | .348 |
| 8 | 36 | .136 | 30 | 14 | .368 |
| 9 | 24 | .1285 | 30 | 16 | .377 |
| 9 | 30 | .136 | | | |
| 9 | 32 | .1405 | | | |

## U. S. Standard Screw Threads

| Diameter of Screw at Top of Thread | Threads per Inch | Diameter at Root of Thread | Width of Flat, Top and Bottom |
|---|---|---|---|
| 1/4 | 20 | .185 | .0063 |
| 5/16 | 18 | .2403 | .0069 |
| 3/8 | 16 | .2936 | .0078 |
| 7/16 | 14 | .3447 | .0089 |
| 1/2 | 13 | .4001 | .0096 |
| 9/16 | 12 | .4542 | .0104 |
| 5/8 | 11 | .5069 | .0114 |
| 3/4 | 10 | .6201 | .0125 |
| 7/8 | 9 | .7307 | .0139 |
| 1 | 8 | .8376 | .0156 |
| 1 1/8 | 7 | .9394 | .0179 |
| 1 1/4 | 7 | 1.0644 | .0179 |
| 1 3/8 | 6 | 1.1585 | .0208 |
| 1 1/2 | 6 | 1.2835 | .0208 |
| 1 5/8 | 5 1/2 | 1.3888 | .0227 |
| 1 3/4 | 5 | 1.4902 | .0250 |
| 1 7/8 | 5 | 1.6152 | .0250 |
| 2 | 4 1/2 | 1.7113 | .0278 |
| 2 1/4 | 4 1/2 | 1.9613 | .0278 |
| 2 1/2 | 4 | 2.1752 | .0313 |
| 2 3/4 | 4 | 2.4252 | .0313 |
| 3 | 3 1/2 | 2.6288 | .0357 |
| 3 1/4 | 3 1/2 | 2.8788 | .0357 |
| 3 1/2 | 3 1/4 | 3.1003 | .0385 |
| 3 3/4 | 3 | 3.3170 | .0417 |
| 4 | 3 | 3.5670 | .0417 |
| 4 1/4 | 2 7/8 | 3.7982 | .0435 |
| 4 1/2 | 2 3/4 | 4.0276 | .0455 |
| 4 3/4 | 2 5/8 | 4.2551 | .0476 |
| 5 | 2 1/2 | 4.4804 | .0500 |
| 5 1/4 | 2 1/2 | 4.7304 | .0500 |
| 5 1/2 | 2 3/8 | 4.9530 | .0526 |
| 5 3/4 | 2 3/8 | 5.2030 | .0526 |
| 6 | 2 1/4 | 5.4226 | .0556 |

Tap drill sizes should be .004 larger than root of thread for 1/4 Tap to .010 for a 2 inch Tap. For some materials more allowance than this should be made.

## Tap Drills

### For Pipe Taps

Drills to be followed with Pipe Reamer, and threaded with Pipe Tap.

| Size Inches | No. of Threads to Inch | Diameter Drill Inches | Size Inches | No. of Threads to Inch | Diameter Drill Inches |
|---|---|---|---|---|---|
| 1/8 | 27 | 11/32 | 1 1/2 | 11 1/2 | 1 3/4 |
| 1/4 | 18 | 29/64 | 2 | 11 1/2 | 2 7/32 |
| 3/8 | 18 | 37/64 | 2 1/2 | 8 | 2 21/32 |
| 1/2 | 14 | 23/32 | 3 | 8 | 3 1/32 |
| 3/4 | 14 | 15/16 | 3 1/2 | 8 | 3 13/16 |
| 1 | 11 1/2 | 1 11/64 | 4 | 8 | 4 3/16 |
| 1 1/4 | 11 1/2 | 1 33/64 | | | |

Tap drill sizes for V threads should be .015 larger than theoretical root of thread for 1/4 Tap to .062 for a 2 inch Tap.

## Decimal Equivalent of the Numbers of Twist Drill and Steel Wire Gauge

| No. | Size of No. in Decimals | No. | Size of No. in Decimals | No. | Size of No. in Decimals | No. | Size of No. in Decimals | No. | Size of No. in Decimals |
|---|---|---|---|---|---|---|---|---|---|
| 1 | .2280 | 17 | .1730 | 33 | .1130 | 49 | .0730 | 65 | .0350 |
| 2 | .2210 | 18 | .1695 | 34 | .1110 | 50 | .0700 | 66 | .0330 |
| 3 | .2130 | 19 | .1660 | 35 | .1100 | 51 | .0670 | 67 | .0320 |
| 4 | .2090 | 20 | .1610 | 36 | .1065 | 52 | .0635 | 68 | .0310 |
| 5 | .2055 | 21 | .1590 | 37 | .1040 | 53 | .0595 | 69 | .0292 |
| 6 | .2040 | 22 | .1570 | 38 | .1015 | 54 | .0550 | 70 | .0280 |
| 7 | .2010 | 23 | .1540 | 39 | .0995 | 55 | .0520 | 71 | .0260 |
| 8 | .1990 | 24 | .1520 | 40 | .0980 | 56 | .0465 | 72 | .0250 |
| 9 | .1960 | 25 | .1495 | 41 | .0960 | 57 | .0430 | 73 | .0240 |
| 10 | .1935 | 26 | .1470 | 42 | .0935 | 58 | .0420 | 74 | .0225 |
| 11 | .1910 | 27 | .1440 | 43 | .0890 | 59 | .0410 | 75 | .0210 |
| 12 | .1890 | 28 | .1405 | 44 | .0860 | 60 | .0400 | 76 | .0200 |
| 13 | .1850 | 29 | .1360 | 45 | .0820 | 61 | .0390 | 77 | .0180 |
| 14 | .1820 | 30 | .1285 | 46 | .0810 | 62 | .0380 | 78 | .0160 |
| 15 | .1800 | 31 | .1200 | 47 | .0785 | 63 | .0370 | 79 | .0145 |
| 16 | .1770 | 32 | .1160 | 48 | .0760 | 64 | .0360 | 80 | .0135 |

## Speed Recommended for Twist Drills

| Diameter of Drill Inches | Speed for Wrought Iron and Steel | Speed for Cast Iron | Speed for Brass | Diameter of Drill Inches | Speed for Wrought Iron and Steel | Speed for Cast Iron | Speed for Brass |
|---|---|---|---|---|---|---|---|
| 1/16 | 1712 | 2383 | 3544 | 1 1/16 | 72 | 108 | 180 |
| 1/8 | 855 | 1191 | 1772 | 1 1/8 | 68 | 102 | 170 |
| 3/16 | 571 | 794 | 1181 | 1 3/16 | 64 | 97 | 161 |
| 1/4 | 397 | 565 | 855 | 1 1/4 | 58 | 89 | 150 |
| 5/16 | 318 | 452 | 684 | 1 5/16 | 55 | 84 | 143 |
| 3/8 | 265 | 377 | 570 | 1 3/8 | 53 | 81 | 136 |
| 7/16 | 227 | 323 | 489 | 1 7/16 | 50 | 77 | 130 |
| 1/2 | 183 | 267 | 412 | 1 1/2 | 46 | 74 | 122 |
| 9/16 | 163 | 238 | 367 | 1 9/16 | 44 | 71 | 117 |
| 5/8 | 147 | 214 | 330 | 1 5/8 | 40 | 66 | 113 |
| 11/16 | 133 | 194 | 300 | 1 11/16 | 38 | 63 | 109 |
| 3/4 | 112 | 168 | 265 | 1 3/4 | 37 | 61 | 105 |
| 13/16 | 103 | 155 | 244 | 1 13/16 | 36 | 59 | 101 |
| 7/8 | 96 | 144 | 227 | 1 7/8 | 33 | 55 | 98 |
| 15/16 | 89 | 134 | 212 | 1 15/16 | 32 | 53 | 95 |
| 1 | 76 | 115 | 191 | 2 | 31 | 51 | 92 |

These speeds should seldom be exceeded, except for Oil Drills and Drills made of high speed steel. Feed per revolution for 1/4 inch Drill, about .005 inch; for 1/2 inch Drill, about .007 inch; for 3/4 inch Drill, .010 inch.

Combination Center Drills for centering lathe work should be run at a suitable speed for the drill point, regardless of countersink. We find it is often the case that these drills are run at a suitable speed for drills, size of large diameter or countersink, which is altogether too slow. The *B* Drill with 1/8 inch point should be run about 850 per minute, the *E* Drill with 1/16 inch point at about 1700. Feed should not exceed that for a small drill of this diameter.

## Combination Center Drills

Although not measuring tools these drills are one of our strong specialties, and we think best to tell our story here in regard to them. We have been making these tools for the past twenty-six years. We made them commercially practical by building special machines for their manufacture and placing them on the market of a quality and at a price that made them a success.

We were entirely alone in their manufacture for the first six or seven years, but after having proved them successful we have had some competition. We feel that this is something of our making, and this is one reason that we are greatly interested in this tool. Our intention is to make the very best tools possible, and we have gone to great expense with special machines and means of testing to insure the very best quality.

Our drills are now made of semi-high speed steel, which is a tungsten alloy, giving great strength. This is a high priced steel, but we charge no more for the drills than those made of carbon steel.

We can make these center drills in a great many styles, shapes, and sizes, for drilling and countersinking the different sizes of machine and wood screws, or for other places where counterbores are used, and can quote prices on special work.

# Diameters of Centers, Sizes of Center Drills and Speeds Recommended

These sizes are for centers to be left in finished work. Before squaring up, some allowance will have to be made. The speed of drills given is for soft steel or iron. Where there is much turning to be done on a piece of work it is advisable to use larger centers, even if they have to be squared out on finishing the work. For lathe-arbors or other work where considerable wear comes on centers, it is advisable to make them a great deal larger, in fact, as large as the work will allow. Where an arbor press is used the centers can be larger than where arbors are driven with a lead hammer, for the reason that where a hammer is used the flat surface of arbor end

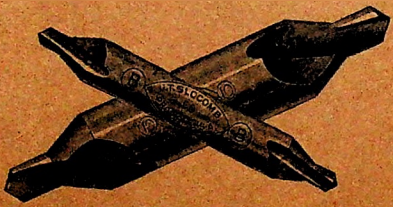
| Diam. Work | Diam. Countersink | Use Size | Drill Speed |
|---|---|---|---|
| 3/16 inch | 3/32 inch | "H" | 2000 |
| 1/4 inch | 7/64 inch | "E" | 1700 |
| 5/16 to 1/2 inch | 1/8 inch | "E" | 1700 |
| 9/16 to 3/4 inch | 9/64 inch | "D" | 1500 |
| 13/16 to 1 inch | 3/16 inch | "D" | 1500 |
| 1 1/16 to 1 1/4 inches | 7/32 inch | "C" | 1000 |
| 1 5/16 to 1 1/2 inches | 1/4 inch | "C" | 1000 |
| 1 9/16 to 1 3/4 inches | 9/32 inch | "C" or "B" | |
| 1 13/16 to 2 inches | 5/16 inch | "B" | 800 |
| 2 1/16 to 2 1/2 inches | 3/8 inch | "F" | 500 |
| 2 1/2 to 3 inches | 7/16 inch | "G" | 500 |

should be as large as possible. In lathe arbors it is advisable to round edge of countersink, so that in putting work upon centers the liability of injury to countersink is lessened. For diameters of drill points on our stock size center drills, please see page 60, catalog. In using Combination Center Drills the best result is obtained by running drill at speed suitable for drill point, and feeding the same as you would for a Twist Drill of this small diameter. When the countersink begins to cut it is best to feed rather lighter, giving the chips a chance to work out.

# Index

(Catalog)

## Index to Measuring Book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